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ABSTRACT

The Competency-based Middle School Program (grades 6-8) and the Competency-based Secondary School Project (grades 9-11) were funded by the South Carolina State Department of Education under the Elementary Secondary Education Act Title IV-C. These programs were to provide instruction based on the principles of mastery learning in helping middle school students gain the necessary skills in language arts, mathematics, science, and social studies to continue learning in the school environment, and to equip secondary school students with skills in language arts, mathematics, consumer economics, and citizenship that they will need as citizens, consumers, and employees. Evaluation utilizing comparison group designs were conducted, and compared the performance of students receiving corrective instruction with an equivalent control group who had not. Results of analysis of data from locally developed summative tests revealed positive trends in the attainment of competencies in mathematics (grades 6, 7, 8, 9, 10), science (grades 6, 8), social studies (grade 6), language arts (grades 9, 10, 11), and consumer economics (grade 9), but not in language arts (grades 6, 7, 8), science (grade 7), social studies (grades 7, 8), and citizenship (grade 9). (Author/RL)

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An Evaluation of Competency-Based School Programs
in a Learning for Mastery Setting

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Abstract

The Competency-based Middle School Program and the Competency-based Secondary School Project were funded by the South Carolina State Department of Education under ESEA Title IV-C monies. The purpose of the competency-based education programs was to provide instruction based on the principles of mastery learning in helping students gain the necessary skills in appropriate content areas to continue learning in the school environment (Middle School) and to equip students with the skills and information they will need as citizens, consumers, and employees (Secondary School). Evaluations utilizing comparison group designs were conducted in the final year of the projects.

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INTRODUCTION

Although little experimental research has been done on competency-based education in the elementary and secondary schools, the importance of accountability and competency-based education in the public schools has been stressed over the past ten years. The theoretical framework of competency-based education has been laid and school systems throughout the country are now attempting to put theory into practice.

Perhaps the earliest evidence of widespread attempts to apply the concept of competency-based education (e.g., possession of skills, knowledge, and understanding to the degree that they can be demonstrated) occurred in the 1920's with the introduction and use of nationally standardized achievement tests in various subject areas. By means of average grade scores achieved by students in a community, a school system was able to report to that community the educational progress of its students. Such reporting of average test scores may be viewed as initial acts by school administrators and school boards in accounting for their performance in educating the students in their schools.

An additional factor promoting the attainment of educational results or student achievement came from government sources such as the Elementary and Secondary Education Act (ESEA) of 1965. ESEA Title I (for improvement of academic achievement of children from low socioeconomic level homes), Title VII (for bilingual education projects), and Title VIII (for programs designed to decrease the number of school dropouts) all contain provisions requiring systematic evaluation of their programs in terms of educational outcomes.

Essentially there has been a steady and increasing demand for better evidence concerning the outcomes of educational programs. In the 1920's the demand was for system-wide results. This later became a demand for school-by-school results and finally a demand for the results of a particular program which might involve only students in a particular school, or specified students in several schools. In all cases, the goal was to discover the extent to which an educational program was meeting its objectives.

In order to apply the principles of competency-based education, the literature reveals that certain components must be present. The following components form a foundation on which a competency-based program can be developed:

1. Measurable objectives in terms of student achievement or behavior must be stated.
2. A comprehensive learning program must be designed so that the measurable student objectives may be attained.
3. Appropriate measuring and testing procedures must be used to evaluate effectiveness of the competency-based program.
4. The results of a competency-based program must be made public so that school is accountable not only to its students but to the community as well.

These components involve defining objectives, instituting programs designed to lead to the attainment of these objectives, measuring success in meeting the objectives, and evaluating and interpreting the results to the community.

Although a variety of instructional strategies is cited in the literature on competency-based education, an appealing as well as an effective instructional model for attaining student objectives is the concept of mastery learning developed by Carroll, Bloom, and Block. Using the principles of immediate feedback and alternative learning strategies, mastery learning appears to be an ideal method for teaching in a competency-based program in that the model helps students meet specified objectives and standards in an organized manner.

Mastery learning is a relatively new, innovative concept which is beginning to reshape educational views and practices. Developed by John Carroll, Benjamin Bloom, James Block and others, mastery learning not only assures that students master basic skills, but that most students master higher level, more complex principles, procedures and processes. James Block states, "Mastery learning is both a philosophy about schooling and an associated set of instructional strategies whereby the philosophy can be implemented in the classroom." Both Block and Bloom state that more effective learning conditions can make it possible for 75 to 90 per cent of the students to achieve at the same high level of achievement as the top 25 per cent learning under regular group-based instructional methods.

Whatever instructional method is used to implement a competency-based educational program, evaluation and accurate measurement of student achievement form a necessary component. One way of assessing a competency-based program is to design measuring instruments (e.g., tests) that are sensitive to "what" students have learned rather than their relative achievement. This approach is called criterion-referenced testing in which the emphasis is placed on a student's standing in relation to a criterion of a given skill or competency rather than on a student's relation to a norm group.

Although there has been some use of criterion-referenced tests to measure student progress in educational programs, most evaluation of educational programs has involved the use of nationally standardized achievement tests. However, too little attention has been paid to investigating the appropriateness of a particular standardized test as a measure of student achievement in the particular educational program in which it is used. A learning program is designed to achieve certain specified objectives; however, it is only to the extent that these objectives coincide with those of the measuring instrument that the instrument is a valid means of measuring how well the learning program has succeeded. In essence, criterion-referenced tests may be more appropriate when a program's objectives are more specific and local in nature.

Although competency-based education is a relatively new concept in American education, South Carolina is among 36 states who have moved to or are moving toward a competency-based framework in their school systems. On August 2, 1978, Governor James B. Edwards signed into law an act that, in effect, posited the

acquisition of minimum performance standards by South Carolina's public school population as a priority for the State's public schools. The Basic Skills Assessment Program (Act 631) charged local school districts with the responsibility of providing instruction in the basic skills of mathematics and in the communication skills of reading and writing to those students that demonstrate deficiencies in one or more of these areas.

In lieu of the imposition of mandatory state legislation, two school districts in the State of South Carolina have implemented competency-based programs through competitive grant proposals to the State Department of Education. Using mastery learning strategies, Richland School District No. 2 and Kershaw County have implemented competency-based programs in the middle school and high school, respectively. The purpose of this paper is to present an overview of the competency-based programs and to provide the evaluations of these programs after a one year implementation period.

COMPETENCY-BASED MIDDLE SCHOOL PROGRAM

Project Abstract or Overview

The Competency-Based Middle School Program at Dent Middle School was designed to assist students in grades 6-8 in the attainment of student objectives at or above pre-established criterion levels. The program incorporates a competency-based (CBE) approach utilizing the principles of mastery learning to attain student learning objectives in the four basic subject areas of language arts, mathematics, science, and social studies.

The Competency-Based Middle School Program at Dent Middle School possesses the following five components:

1. defined minimum competencies for each of the four curriculum areas;
2. a criterion-referenced competency-based testing program;
3. a middle school CBE instructional program for four academic areas;
4. a teacher training program for instructing in a CBE program; and,
5. CBE program implementation procedures.

The competencies of this program reflect a two-part philosophy. First, there are certain skills which middle school students must possess if they are to function effectively. These skills fall into two categories: (1) there are academic skills which students must possess in order to be successful in their studies at the middle and high school level; and, (2) there are life skills which students need to function effectively as members of our society. The competencies identified by the project reflect both academic and life skills. However, most of the skills are academic in nature because such a large part of the middle school student's life centers around school and will continue to do so through the high school years.

The second part of the philosophy of the Competency-Based Middle School Program evolves from mastery learning research. Under appropriate instructional circumstances almost all students can learn the competencies that have been identified as essential.

A list of the defined minimum competencies are made available to the Dent Middle School staff and faculty at the beginning of each academic year. The competencies are a part of the total scope and sequence of skills and concepts which Dent teachers have developed and are expected to strive to teach. The teachers are encouraged to share these competencies with students as basic skills objectives which the students will strive to master.

All students in grades 6-8 who did not demonstrate mastery of the defined minimum competencies in the four basic subject areas served as a target group for the project. In identifying the target group for the Competency-Based Middle School Program, CBE entering tests were administered to students prior to their entering the 6th grade at Dent Middle School. Also, CBE summative tests were administered

to all 6th, 7th, and 8th grade students in each subject area. Both the entering tests and the summative tests were administered by subject area teachers. Based on the results of these tests, students were either placed in CBE classes or remained in their regular classes.¹

Students placed in CBE classes received corrective instruction using the CBE instructional units and related CBE materials as the main source of instructional materials. Students in the regular classrooms who also needed remediation received help during classroom time or during time allotted by the classroom teacher outside of regularly scheduled class time. Remediation for these students was also done with the use of the CBE Instructional Units and materials.

In January (first semester) and May (second semester) of 1980 summative posttests were administered to all 6th, 7th, and 8th graders. Students were assessed with test items keyed to instruction in the defined minimum competencies at their appropriate grade level. Analysis of the data was achieved by comparing the performance of the students being served by the project with an equivalent control group of students who had not been served by the project.

Results of the data analysis revealed positive trends in the attainment of competencies in mathematics (grades 6, 7, 8), science (grades 6, 8), and social studies (grade 6) over a one year implementation of the Middle School Competency-Based Program. The competencies in language arts (grades 6, 7, 8), science (grade 7), and social studies (grades 7, 8) were not supported by the data. In addition, hypotheses dealing with CTBS/S subtest scale scores (grades 6, 7, 8) in language arts, mathematics, science, and social studies revealed no significant differences (with few exceptions) between project students and their counterparts. Given the scope of the Competency-Based Middle School Program in terms of competencies and grade levels observed, the results appeared to be supportive of a middle school competency-based education program using mastery learning instructional techniques and procedures.

¹During the 1979-80 implementation year, students were selected for CBE classes on the criteria of CTBS/S results and teacher recommendation as well.

Evaluation Design

1. Evaluation Design:

The purpose of the evaluation design was to determine if students in the Competency-Based Middle School Program (1979-80 implementation year) scored significantly higher (.05 level) on measures of cognitive achievement (CBE summative tests and CTBS subtests) than their counterparts, students in a matched control school.

The evaluation utilized a posttest comparison with matched groups design. Statistical control was provided using a matched groups model in which students in the treatment and comparison conditions were matched on the basis of their pretest scores with treatment as the independent variable and posttest achievement in language, mathematics, science, and social studies (as measured by first and second semester summative tests and CTBS subtests) as dependent variables.¹ Statistical analyses were performed by grade level. Students identified as EMH, EH, and LD were not included in the analyses.

¹ The Competency-Based Middle School Program served students who needed remediation in CBE classes or in regular classes. To analyze the results of the study in the most efficient manner, experimental and control students were compared within the various "cells" (1, 2, 3, or 4) diagrammed below.

		Class	
		Regular	CBE
(predetermined mastery status)	NM	2	1
	M	4	3

where, M = master and NM = nonmaster in a particular content area (i.e., language arts, mathematics, science, or social studies)

Predetermined mastery status was calculated from scores on 5th grade entering tests (6th grade analysis), 6th grade - 2nd semester summative pilot tests (7th grade analysis), and 7th grade - 2nd semester summative pilot tests (8th grade analysis) in the content areas of language arts, mathematics, science, and social studies.

Experimental and control students were then matched (paired) within cells using the following procedure. For 6th grade analysis, control students were randomly matched to experimental students from the same stratum (widths ranging from 2 to 4 raw score points) of the appropriate 5th grade entering test administered in spring 1979. For 7th and 8th grade analysis, control students were randomly matched to experimental students from the same stratum (widths ranging from 20 to 40 scale score points) of the appropriate CTBS/S subtest administered in spring 1979.

In essence, the summative evaluation strategy used both experimental and statistical controls in an attempt to establish the time merits of the solution intervention. Experimental control was accomplished by matching the experimental school (Dent Middle School) with a control school on such factors as total enrollment, sex, race, and CTBS achievement. Statistical control was accomplished through the use of a matched groups model.

In an effort to reduce the effects of extraneous variables, the experimental and control schools were controlled during the implementation period as well as during the pilot testing period. Both the experimental and control schools received identical pretesting and posttesting procedures. Aside from the solution intervention in the experimental school, no special programs occurred in either the experimental or control school during the implementation period. In addition, students were not identified as being part of an experimental or control group, per se.

In effect, extraneous variables such as history, maturation, testing, instrumentation, statistical regression, selection, and experimental mortality were controlled experimentally and statistically through the procedures described above to address the question of internal validity (i.e., does the solution intervention in fact make a difference?). Through the use of matching experimental and control schools and through the use of the matched groups model, the factors jeopardizing external validity (i.e., the interaction of the solution intervention with testing, selection, history, and maturation) were minimized.

2. Evaluation Instruments:

a. CBE Summative Tests (Objectives 1-4)

The CBE summative tests were locally developed, criterion-referenced tests used to assess mastery in language arts, mathematics, science and social studies in grades 6-8 during the 1979-80 implementation year.

Validity

Content validity is the primary concern when assessing the validity of criterion-referenced achievement tests. Evidence for the content validity of the CBE tests is logical in nature. As described in the CBE Testing Manual, the items written for the CBE item pools were explicitly deduced from the competencies and indicators. A criterion-referenced testing specialist reviewed the test items to determine the match between competencies, indicators and sample test items.

Reliability

Internal consistency, stability and equivalence were examined for the CBE summative item pool. Internal consistency, as measured by KR-20 reliability was determined for each test. A random sample of tests was administered to a random sample of students in order to examine stability and equivalence. The results of these reliability studies follow.

Internal Consistency

The KR-20 can be thought of as a measure of the extent to which items on a test consistently measure a variable. In many ways it is a measure of item homogeneity, or the extent to which items of a test measure the same trait. Since each CBE test covers several competencies, it is not expected that items on the test will be homogeneous. The KR-20 for each CBE test is shown in Table 1. Since KR-20's are also affected by test length, the number of items on each test is also reported on Table 1.

A final reminder about interpretation of these reliability indices is the fact that reliability is affected by the variability of subjects' test scores. To the extent that scores on mastery tests can be expected to be relatively homogeneous, reliability can be expected to be relatively low. For example, this is the case for the 8th grade, 1st semester language arts test, where over half the students taking the test received perfect scores.

TABLE 1

KR-20'S FOR CBE TESTS

SEMESTER 1 TESTS				
TEST	GRADE	NO. OF ITEMS	NO. COMPETENCIES	KR-20
Language Arts	6	47	4	.88
Mathematics	6	55	10	.93
Science	6	15	3	.74
Social Studies	6	27	3	.82
Language Arts	7	42	3	.83
Mathematics	7	20	4	.90
Science	7	18	5	.69
Social Studies	7	20	3	.82
Language Arts	8	10	1	.44
Mathematics	8	15	3	.85
Science	8	20	4	.66
Social Studies	8	20	3	.70
SEMESTER 2 TESTS				
Language Arts	6	34	4	.78
Mathematics	6	38	8	.87
Science	6	20	4	.69
Social Studies	6	21	7	.78
Language Arts	7	60	7	.84
Mathematics	7	43	7	.94
Science	7	16	4	.79
Social Studies	7	35	3	.91
Language Arts	8	Writing Sample		
Mathematics	8	23	4	.91
Science	8	25	5	.77
Social Studies	8	38	7	.82

Stability

Stability of scores on the CBE examinations was studied by considering a sample of tests and students. For this study two second semester tests, the 7th grade mathematics test and the 6th grade social studies test, were randomly selected to be administered on two separate occasions. Each test was administered to one randomly selected class of students. There was approximately a three week interval between the first and second test administered. This time interval was selected because it approximates the time which a student would spend remediating deficiencies before being retested. For mathematics the correlation between scores on the two occasions was .73. For social studies the correlation was .74.

Equivalence

Equivalence was examined by observing the performance of a random sample of students on a random sample of second semester tests. The randomly selected tests were 7th grade language arts and 8th grade mathematics. Parallel forms of each of these tests were prepared using the CBE item pool and the forms were administered on two occasions, with approximately 3 weeks between test administrations. The correlation between scores on the two forms of the language arts test was .77. For mathematics, the correlation between scores on the two forms of the test was .71.

Rasch Analysis

In addition to classical item analysis procedures, language arts and mathematics summative tests were analyzed using the Rasch model. The Rasch model is a latent trait psychometric model which describes the probability of a subject of a given ability correctly responding to an item of a given difficulty. The model is based on two propositions:

1. The easier the item, the more likely it is that a given person will make a correct response.
2. The greater a person's ability, the more likely it is that a correct response will be made to a given item.

The Rasch model can be written:

$$P(X = 1 | \beta, \delta) = \frac{e^{(\beta - \delta)}}{1 + e^{(\beta - \delta)}} \quad (1)$$

In this equation P is the probability of a correct response, β is the ability of the subject, δ is the difficulty of the item, and e is the base of the natural log. If β is greater than δ , that is when the subject has more ability than the item has difficulty, then the probability favors the subject correctly answering the item. If δ is greater than β , that is when the item has more difficulty than the subject has ability, the probability favors the subject incorrectly answering the item.

When subjects or items behave in improbable ways, for example if high ability subjects miss easy items or if the proportion of subjects correctly answering an item is not highly related to the ability of subjects, they are referred to as "misfitting" the model. The Rasch model allows test practitioners to identify misfitting items and/or misfitting subjects.

The results of the Rasch analysis of the first semester math and language arts tests show that very few items or people misfit. Item and person fit are considered excellent for these 6 tests of student competency. The numbers of misfitting items and subjects are summarized in Table 2, Summary of Subject and Item Misfit. The average proportion of misfitting items was .07. The average proportion of misfitting subjects was .02. The maximum number of misfitting items was 4 and there were 2 tests, 7th and 8th grade math, for which there were no misfitting items. The least number of misfitting subjects on any test was 18. A total of 2019 subjects responded to 189 items and a total of 44 subjects misfit the items.

TABLE 2

SUMMARY OF SUBJECT AND ITEM MISFIT

Test Name	No. of Subjects		# of Items	Misfit Information		Mean Ability	
	Total Ss	Non-zero + non-perfect		# of Items Misfit	# of Ss Misfit	All Ss	Deleting Misfitting Ss
8th L. Arts	368	159	10	0	2	1.86	1.91
8th Math	340	264	15	4	2	1.66	1.68
7th L. Arts	385	334	42	3	18	2.06	2.35
7th Math	328	246	20	0	2	1.50	1.53
6th L. Arts	298	297	47	4	11	1.07	1.14
6th Math	300	296	55	2	9	1.80	1.87
Totals	2019	1596	189	13	44		

b. Comprehensive Tests of Basic Skills (Objectives 9-12)

This standardized norm-referenced achievement test was administered district wide in grades 1-12. In addition, the State of South Carolina has adopted the Comprehensive Tests of Basic Skills for its state-wide testing program in grades 3, 6, and 11.

Validity: Although the content validity of the CTBS/S subtests in language arts, mathematics, science, and social studies is not as appropriate as the locally developed criterion-referenced tests with respect to the CBE competencies to be mastered by project students, these instruments were utilized to provide a convenient and cost effective supplemental assessment of project students and their counterparts. The CTBS subtests provided a "macroscopic view" of important content areas and behavioral levels on a national level.

Reliability: The technical bulletin provides information on the internal consistency of each subtest at each grade level. These reliability coefficients range from .82 to .96 for total language, total mathematics, science and social studies.

3. Data Gathering Evidence:

The following Chart A depicts an overview of the design in terms of how each project objective relates to evaluation instruments, data collection, and data analysis.

Results and Analysis

The reader is referred to the preceding section (Evaluation Design) for an explanation of the posttest comparison with matched groups design used in the analysis of the data. In an effort to make this section more readable, Tables 3-15 follow the narrative for this section.

Results for Each Objective

Objective #1. By January 1980 (1st semester) and May 1980 (2nd semester) the project students in Dent Middle School (grades 6-8) will demonstrate significantly higher (.05 level) achievement (mastery) than an equivalent control group of students who have not been served by the project. The data will be obtained in January 1980 and May 1980 from locally developed summative tests in the area of language arts.

The first hypothesis is investigated by examining the analysis of mean differences and t-values (Tables 3-5) between the experimental and comparison groups for the criterion-referenced summative posttests (1st and 2nd semester) in language arts competencies (grades 6-8).

To observe whether project students demonstrated significantly higher (.05) achievement (mastery) than an equivalent control group of students who had not been served by the project, Cells 1 and 2 (students deficient in entering competencies in CBE

Chart A
Record of Data Collection and Analysis

OBJECTIVE	EVALUATION INSTRUMENTS	DATA COLLECTION			DATA ANALYSIS	
		COLLECTED ON WHOM	WHEN COLLECTED	COLLECTED BY WHOM	HOW ANALYZED	ANALYSIS
Objective No. 1	1st Semester and 2nd Semester CBE Summative Tests (Language Arts)	6th, 7th, and 8th graders (Experimental and Control School)	Jan. 1980 May 1980	Project Staff	Posttest com- parison with matched group design	Matched pair t-test
Objective No. 2	1st Semester and 2nd Semester CBE Summative Tests (Mathematics)	6th, 7th, and 8th graders (Experimental and Control School)	Jan. 1980 May 1980	Project Staff	Posttest com- parison with matched group design	Matched pair t-test
Objective No. 3	1st Semester and 2nd Semester CBE Summative Tests (Science)	6th, 7th, and 8th graders (Experimental and Control School)	Jan. 1980 May 1980	Project Staff	Posttest com- parison with matched group design	Matched pair t-test
Objective No. 4	1st Semester and 2nd Semester CBE Summative Tests (Social Studies)	6th, 7th and 8th graders (Experimental and Control School)	Jan. 1980 May 1980	Project Staff	Posttest com- parison with matched group design	Matched pair t-test
Objective No. 5	CTBS/S Total Language	6th, 7th and 8th graders	April 1979, April 1980	Regular District Testing/Site Faculty	Posttest com- parison with matched group design	Matched pair t-test

Chart A
Record of Data Collection and Analysis

OBJECTIVE	EVALUATION INSTRUMENTS	DATA COLLECTION			DATA ANALYSIS	
		COLLECTED ON WHOM	WHEN COLLECTED	COLLECTED BY WHOM	HOW ANALYZED	ANALYSIS
Objective No. 6	CTBS/S Total Mathematics	6th, 7th and 8th graders	April, 1979, April 1980	Regular District Testing/Site Faculty	Posttest com- parison with matched group design	Matched pair t-test
Objective No. 7	CTBS/S Science	6th, 7th and 8th graders	April 1979, April 1980	Regular District Testing/Site Faculty	Posttest com- parison with matched group design	Matched pair t-test
Objective No. 8	CTBS/S Social Studies	6th, 7th and 8th graders	April 1979, April 1980	Regular District Testing/Site Faculty	Posttest com- parison with matched group design	Matched pair t-test

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classes and regular classes, respectively) of Tables 3-5 were examined. Mean differences between the experimental and comparison groups are presented in Tables 3-5 in terms of raw score (RS) and mastery percentage (M) by competency and in terms of raw score and numbers of competencies mastered by total competency area (e.g., language arts, grade 6, semester 1).

As depicted in Tables 3-5, project students (Cell 1) demonstrated significantly higher achievement than control students in the language arts competency of Use References (6-1, RS). Project students (Cell 2) demonstrated significantly higher achievement than control students in the language arts competencies of Parts of Speech (7-1, M), total competency area (7-1, M), Outline (7-2, RS), total competency area (7-2, RS), and Express Oneself Clearly - Skill 2 (8-2, RS, M).

Due to the scope of the first hypothesis in terms of competencies and grade levels observed, trends in the data were considered in determining the significance of the results. On the basis of this discussion, the first hypothesis does not appear to be supported by the data.

Objective #2. By January 1980 (1st semester) and May 1980 (2nd semester) the project students in Dent Middle School (grades 6-8) will demonstrate significantly higher (.05 level) achievement (mastery) than an equivalent control group of students who have not been served by the project. The data will be obtained in January 1980 and May 1980 from locally developed summative tests in the area of mathematics.

The second hypothesis is investigated by examining the analysis of mean differences and t-values (Tables 6-8) between the experimental and comparison groups for the criterion-referenced summative posttests (1st and 2nd semester) in mathematics competencies (grades 6-8).

To observe whether project students demonstrated significantly higher (.05) achievement (mastery) than an equivalent control group of students who had not been served by the project, Cells 1 and 2 (students deficient in entering competencies in CBE classes and regular classes, respectively) of Tables 6-8 were examined. Mean differences between the experimental and comparison groups are presented in Tables 6-8 in terms of raw score (RS) and mastery percentage (M) by competency and in terms of raw score and numbers of competencies mastered by total competency area (e.g., mathematics, grade 6, semester 1).

As depicted in Tables 6-8, project students (Cell 1) demonstrated significantly higher achievement than control students in the mathematics competencies of Divide Whole Numbers (6-1, RS), Add/Subtract Decimals (6-1, RS), Units of Measure (6-1, RS), Divide Fractions (6-2, RS and M), Percent and Decimals (6-2, RS and M), Read Graphs (6-2, RS), Word Problems (6-2, RS), total competency area (6-2, RS and M), and all competencies and total competency areas in grade 8 (8-1, 8-2: RS and M).

Project students (Cell 2) demonstrated significantly higher achievement than control students in the mathematics competencies of Divide Whole Numbers (7-1, RS), Divide Decimals (7-1, RS and M), total competency area (7-1, RS and M), Percent of

a Number (7-2, RS and M), Fractional Equivalent of a Percent (7-2, RS and M), Area (7-2, RS), total competency area (7-2, RS and M), and all competencies and total competency areas in grade 8 (8-1, 8-2: RS and M).

Due to the scope of the second hypothesis in terms of competencies and grade levels observed, trends in the data were considered in determining the significance of the results. On the basis of this discussion, the second hypothesis appears (with reservation) to be supported by the data.

Objective #3. By January 1980 (1st semester) and May 1980 (2nd semester) the project students in Dent Middle School (grades 6-8) will demonstrate significantly higher (.05 level) achievement (mastery) than an equivalent control group of students who have not been served by the project. The data will be obtained in January 1980 and May 1980 from locally developed summative tests in the area of science.

The third hypothesis is investigated by examining the analysis of mean differences and t-values (Tables 9-11) between the experimental and comparison groups for the criterion-referenced summative posttests (1st and 2nd semester) in science competencies (grades 6-8).

To observe whether project students demonstrated significantly higher (.05) achievement (mastery) than an equivalent control group of students who had not been served by the project, Cells 1 and 2 (students deficient in entering competencies in CBE classes and regular classes, respectively) of Tables 9-11 were examined. Mean differences between the experimental and comparison groups are presented in Tables 9-11 in terms of raw score (RS) and mastery percentage (M) by competency and in terms of raw score and numbers of competencies mastered by total competency area (e.g., science, grade 6, semester 1).

As depicted in Tables 9-11, project students (Cell 1) demonstrated significantly higher achievement than control students in the science competencies of Personal Health (6-2, RS), Conservation (6-2, RS), Energy (6-2, RS), total competency area (6-2, RS and M), Metric Measurement (8-1, RS), Interpret Maps (8-1, RS), total competency area (8-1, RS), Seasonal Changes (8-2, RS), and total competency area (8-2, RS and M). Control students demonstrated significantly higher achievement than project students (Cell 1) in the total competency area of grade 7-1 (RS and M).

Project students (Cell 2) demonstrated significantly higher achievement than control students in the science competencies of Models, Diagrams, Charts (grade 6-1, RS), Ecology (7-2, RS and M), Metric Measurement (8-1, M), Interpret Maps (8-1, RS), total competency area (8-1, M), Seasonal Changes (8-2, RS and M), Reference Skills (8-2, M), Terms (8-2, RS and M), Alleviating Environmental Problems (8-2, M), and total competency area (8-2, RS and M).

Due to the scope of the first hypothesis in terms of competencies and grade levels observed, trends in the data were considered in determining the significance of the results. On the basis of this discussion, the third hypothesis appears (with reservation) to be supported by the data in grades 6 and 8 only.

Objective #4. By January 1980 (1st semester) and May 1980 (2nd semester) the project students in Dent Middle School (grades 6-8) will demonstrate significantly higher (.05 level) achievement (mastery) than an equivalent control group of students who have not been served by the project. The data will be obtained in January 1980 and May 1980 from locally developed summative tests in the area of social studies.

The fourth hypothesis is investigated by examining the analysis of mean differences and t-values (Tables 12-14) between the experimental and comparison groups for the criterion-referenced summative posttests (1st and 2nd semester) in social studies competencies (grades 6-8).

To observe whether project students demonstrated significantly higher (.05) achievement (mastery) than an equivalent control group of students who had not been served by the project, Cells 1 and 2 (students deficient in entering competencies in CBE classes and regular classes, respectively) of Tables 12-14 were examined. Mean differences between the experimental and comparison groups are presented in Tables 12-14 in terms of raw score (RS) and mastery percentage (M) by competency and in terms of raw score and numbers of competencies mastered by total competency area (e.g., social studies, grade 6, semester 1).

As depicted in Tables 12-14, project students (Cell 1) demonstrated significantly higher achievement than control students in the social studies competencies of Culture (6-1, M), Map Skills (6-1, RS and M), total competency area (6-1, RS and M), Government (6-2, M), Needs/Wants (6-2, RS and M), Supply and Demand (6-2, M), total competency area (6-2, RS and M), Rights and Responsibilities (8-2, M), and Capitalism (8-2, RS).

Project students (Cell 2) demonstrated significantly higher achievement than control students in the social studies competencies of total competency area (7-1, RS), Facts About Cultures (7-2, RS and M), Three Branch System of Government (8-2, RS and M), Relationship between State and Federal Government (8-2, RS), Rights and Responsibilities (8-2, M), Supply and Demand (8-2, RS), Economic Terminology (8-2, RS), Comparative Shopping (8-2, RS), Cultural Aspects of Historical Events (8-2, RS), and total competency area (8-2, RS and M).

Due to the scope of the fourth hypothesis in terms of competencies and grade levels observed, trends in the data were considered in determining the significance of the results. On the basis of this discussion, the fourth hypothesis appears (with reservation) to be supported by the data in grade 6 only.

Objective #5. By April 1980 the project students in Dent Middle School (grades 6-8) will achieve significantly higher (.05 level) than an equivalent control group of students who have not been served by the project. The comparison data will be obtained in April 1980 from the language arts subtest of the CTBS/S. Pretest data will be obtained in April 1979 from the language arts subtest of the CTBS/S.

The fifth hypothesis is investigated by examining the analysis of mean differences and t-values (Table 15) between the experimental and comparison groups for the total language subtest of the Comprehensive Tests of Basic Skills. Objective 5 is

related to Objective 1 in that the content area of language arts was observed in both objectives. Although attainment of Objective 5 is not absolutely essential to program success, the CTBS/S subtest in language arts provides a "macroscopic view" of an important content area on a national level.

To observe whether project students demonstrated significantly higher (.05 level) achievement than an equivalent control group of students who had not been served by the project, Cells 1 and 2 (students deficient in entering competencies in CBE classes and regular classes, respectively) of Table 15 were examined. As indicated in Table 15, no significant mean differences were found between project students and control students on posttest achievement for CTBS/S total language subtest scale scores in grades 6, 7, and 8. On the basis of this discussion, the fifth hypothesis does not appear to be supported by the data.

Objective #6. By April 1980 the project students in Dent Middle School (grades 6-8) will achieve significantly higher (.05 level) than an equivalent control group of students who have not been served by the project. The comparison data will be obtained in April 1980 from the mathematics subtest of the CTBS/S. Pretest data will be obtained in April 1979 from the mathematics subtest of the CTBS/S.

The sixth hypothesis is investigated by examining the analysis of mean differences and t-values (Table 15) between the experimental and comparison groups for the total mathematics subtest of the Comprehensive Tests of Basic Skills. Objective 6 is related to Objective 2 in that the content area of mathematics was observed in both objectives. Although attainment of Objective 6 is not absolutely essential to program success, the CTBS/S subtest in mathematics provides a "macroscopic view" of an important content area on a national level.

To observe whether project students demonstrated significantly higher (.05 level) achievement than an equivalent control group of students who had not been served by the project, Cells 1 and 2 (students deficient in entering competencies in CBE classes and regular classes, respectively) of Table 15 were examined. As indicated in Table 15, no significant mean differences were found between project students and control students on posttest achievement for CTBS/S total mathematics subtest scale scores in grades 6, 7, and 8. On the basis of this discussion, the sixth hypothesis does not appear to be supported by the data.

Objective #7. By April 1980 the project students in Dent Middle School (grades 6-8) will achieve significantly higher (.05 level) than an equivalent control group of students who have not been served by the project. The comparison data will be obtained in April 1980 from the science subtest of the CTBS/S. Pretest data will be obtained in April 1979 from the Science subtest of the CTBS/S.

The seventh hypothesis is investigated by examining the analysis of mean differences and t-values (Table 15) between the experimental and comparison groups for the science subtest of the Comprehensive Tests of Basic Skills. Objective 7 is related

to Objective 3 in that the content area of science was observed in both objectives. Although attainment of Objective 7 is not absolutely essential to program success, the CTBS/S subtest in science provides a "macroscopic view" of an important content area on a national level.

To observe whether project students demonstrated significantly higher (.05 level) achievement than an equivalent control group of students who had not been served by the project, Cells 1 and 2 (students deficient in entering competencies in CBE classes and regular classes, respectively) of Table 15 were examined.

As depicted in Table 15, no significant mean differences were found between project students (Cell 1) and control students on posttest achievement for CTBS/S science subtest scale scores in grades 6, 7, and 8. Project students (Cell 2) demonstrated significantly higher achievement than control students on posttest achievement for CTBS/S science subtest scale scores in grade 6. On the basis of this discussion, the seventh hypothesis does not appear to be supported by the data.

Objective #8. By April 1980 the project students in Dent Middle School (grades 6-8) will achieve significantly higher (.05 level) than an equivalent control group of students who have not been served by the project. The comparison data will be obtained in April 1980 from the social studies subtest of the CTBS/S. Pretest data will be obtained in April 1979 from the social studies subtest of the CTBS/S.

The eighth hypothesis is investigated by examining the analysis of mean differences and t-values (Table 15) between the experimental and comparison groups for the social studies subtest of the Comprehensive Tests of Basic Skills. Objective 8 is related to Objective 4 in that the content area of social studies was observed in both objectives. Although attainment of Objective 8 is not absolutely essential to program success, the CTBS/S subtest in social studies provides a "macroscopic view" of an important content area on a national level.

To observe whether project students demonstrated significantly higher (.05 level) achievement than an equivalent control group of students who had not been served by the project, Cells 1 and 2 (students deficient in entering competencies in CBE classes and regular classes, respectively) of Table 15 were examined.

As depicted in Table 15, control students demonstrated significantly higher achievement than project students (Cell 1) on posttest achievement for CTBS/S social studies scale scores in grade 7. No significant mean differences were found between project students (Cell 2) and control students on posttest achievement for CTBS/S social studies subtest scale scores in grades 6, 7, and 8. On the basis of this discussion, the eighth hypothesis does not appear to be supported by the data.

Notations for Tables 3-15 is presented as follows:

NOTE:

Cell 1 = predetermined nonmasters compared in CBE classes

Cell 2 = predetermined nonmasters compared in regular classes

Cell 3 = predetermined masters compared in CBE classes

Cell 4 = predetermined masters compared in regular classes

$\bar{D}$ = mean difference (experimental - control)

RS = raw score (mean difference)

M = mastery (mean difference: percentage)

Total M = masters (mean difference: numbers of competencies mastered)

* = $p < .05$

** = $p < .01$

*** = $p < .001$

Table 3. Mean differences and t-values for criterion-referenced summative posttests in sixth grade language arts competencies.

Language Arts, Grade 6, Semester 1

Cell

Competency Raw Score/Mastery	No. of Items	1 (N= 3)		2 (N= 0)		3 (N= 19)		4 (N= 112)	
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Follow Directions - RS	15	+2.67	+4.00			-0.16	-0.30	-0.08	-0.35
- M		+0.67	+2.00			+0.05	+0.29	0.00	0.00
2. Use References - RS	12	+3.00	+5.20*			-0.42	-0.51	-0.32	-1.40
- M		0.00	-			-0.16	-1.14	-0.07	-1.07
3. Recognize Complete Sentence - RS	10	+0.67	+0.36			-0.74	-1.05	+0.26	+0.74
- M		0.00	-			-0.05	-0.57	+0.07	+1.13
4. Identify Parts of Sentence - RS	10	+0.33	+0.23			-0.89	-1.98	+0.40	+1.32
- M		0.00	-			-0.16	-1.37	+0.11	+1.53
TOTAL - RS	47	+6.67	+3.29			-2.21	-1.17	+0.26	+0.31
- M		+0.67	+2.00			-0.32	-1.06	+0.11	+0.63

Language Arts, Grade 6, Semester 2

Cell

Competency Raw Score/Mastery	No. of Items	1 (N=3)		2 (N=0)		3 (N= 13)		4 (N=96)	
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Spelling - RS	10	-0.33	-1.00			-0.92	-2.22*	+0.14	+0.81
- M		0.00	-			-0.38	-2.13*	+0.06	+1.14
2. Plural and Possessive Nouns - RS	10	-0.67	-0.50			-0.31	-0.51	-0.13	-0.50
- M		+0.33	+1.00			+0.08	+0.43	-0.06	-1.00
3. Main Idea - RS	5	+0.33	+0.50			-0.54	-1.24	-0.20	-1.41
- M		+0.33	+1.00			-0.31	-1.48	+0.03	+0.90
4. Sequence - RS	9	+0.33	+0.18			+0.15	+0.16	+0.71	+3.18**
- M		+0.33	+1.00			+0.23	+1.00	+0.14	+2.39*
TOTAL - RS	34	-0.33	-0.10			-1.62	-1.03	+0.52	+0.94
- M		+1.00	+1.73			-0.38	-0.75	+0.17	+1.23

Table 4. Mean differences and t-values for criterion-referenced summative posttests in seventh grade language arts competencies.

Language Arts, Grade 7, Semester 1

Cell

Competency Raw Score/Mastery		No. of Items	1 (N= 19)		2 (N= 23)		3 (N= 3)		4 (N= 102)	
			$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Punctuation	- RS	15	-0.42	-0.73	+0.22	+0.40	+1.00	+0.65	-0.12	-0.73
	- M		-0.21	-1.07	+0.13	+0.83	+0.33	+1.00	+0.03	+0.60
2. Capitalization	- RS	12	-0.11	-0.24	+0.57	+1.16	0.00	0.00	+0.03	+0.22
	- M		+0.05	+0.57	+0.13	+1.82	0.00	-	+0.04	+2.03*
3. Parts of Speech	- RS	15	+0.84	+0.69	+1.61	+2.01	+2.00	+0.79	+1.76	+4.32***
	- M		+0.05	+0.37	+0.30	+2.30*	+0.33	+1.00	+0.18	+3.34***
TOTAL	- RS	42	+0.32	+0.17	+2.39	+1.90	+3.00	+0.85	+1.67	+3.09**
	- M		-0.10	-0.33	+0.56	+2.51*	+0.67	+1.00	+0.25	+2.77**

Table 4 (continued)

Language Arts, Grade 7, Semester 2

Cell

Competency Raw Score/Mastery		No. of Items	1 (N=16)		2 (N=19)		3 (N= 3)		4 (N= 89)	
			$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Pronouns	- RS	10	-0.75	-1.34	+0.68	+1.61	0.00	0.00	+0.64	+2.47 [*]
	- M		-0.19	-1.14	+0.21	+1.46	0.00	0.00	+0.21	+3.03 ^{**}
2. Subject-Verb Agreement	- RS	8	+0.50	+1.17	+0.32	+1.19	+0.33	+1.00	+0.12	+1.26
	- M		+0.06	+0.56	+0.05	+0.57	0.00	-	+0.01	+0.58
3. Regular and Irregular Verbs	- RS	8	-0.13	-0.21	+0.32	+0.88	-0.33	-0.14	+0.27	+1.62
	- M		+0.06	+0.37	+0.05	+0.33	0.00	0.00	+0.08	+1.62
4. Tenses	- RS	8	+0.19	+0.59	+0.05	+0.22	+0.33	+1.00	+0.18	+1.36
	- M		+0.06	+1.00	+0.05	+1.00	0.00	-	+0.03	+1.75
5. Modifiers	- RS	8	+0.31	+0.84	0.00	0.00	+1.67	+1.39	+0.36	+2.33 [*]
	- M		+0.13	+1.00	-0.05	-1.00	+0.33	+1.00	+0.04	+1.65
6. Proofreading	- RS	10	+0.31	+0.39	+0.79	+1.28	+2.33	+2.65	+0.69	+4.26 ^{***}
	- M		-0.13	-0.62	0.00	0.00	+0.33	+1.00	+0.06	+1.39
7. Outline	- RS	8	+0.13	+0.19	+1.42	+3.13 ^{**}	+2.00	+3.46	+1.24	+4.73 ^{***}
	- M		-0.06	-1.00	+0.16	+1.84	0.00	-	+0.17	+3.02 ^{**}
TOTAL	- RS	60	+0.56	+0.22	+3.58	+2.64 [*]	+6.33	+2.43	+3.49	+4.56 ^{***}
	- M		-0.06	-0.12	+0.47	+1.53	+0.67	+0.76	+0.61	+3.95 ^{***}

Table 5. Mean differences and t-values for criterion-referenced summative posttests in eighth grade language arts competencies.

Language Arts, Grade 8, Semester 1

Cell

Competency Raw Score/Mastery	No. of Items	1 (N= 23)		2 (N=43)		3 (N= 2)		4 (N= 102)		
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	
1. Read for Factual Information	- RS	1	+0.09	+0.30	+0.02	+0.13	0.00	-	+0.21	+2.10*
	- M		-0.87	-1.45	+0.02	+0.44	0.00	-	0.00	0.00

Language Arts, Grade 8, Semester 2

Cell

Competency Raw Score/Mastery		No. of Items	1 (N= 22)		2 (N=37)		3 (N=2)		4 (N= 91)	
			$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Express Oneself Clearly - Skill 1	- RS	1	+0.14	+1.82	+0.11	+1.67	0.00	-	+0.04	+1.65
	- M		+0.14	+1.82	+0.11	+1.67	0.00	-	+0.44	+1.65
2. Express Oneself Clearly - Skill 2	- RS	1	+0.14	+1.82	+0.16	+2.23 [*]	0.00	-	+0.07	+2.16 [*]
	- M		+0.14	+1.82	+0.16	+2.23 [*]	0.00	-	+0.07	+2.16 [*]
3. Express Oneself Clearly - Skill 3	- RS	1	+0.05	+0.44	+0.08	+1.36	0.00	-	+0.03	+1.14
	- M		+0.05	+0.44	+0.08	+1.36	0.00	-	+0.03	+1.14
4. Write A Report	- RS	24	-2.36	-1.31	-1.26	-1.36	+2.00	+0.50	+0.80	+1.68
	- M		-0.17	-1.00	+0.02	+0.21	0.00	0.00	+0.25	+4.77 ^{***}

Table 6. Mean differences and t-values for criterion-referenced summative posttests in sixth grade mathematics competencies.

Mathematics, Grade 6, Semester 1

Cell

Competency Raw Score/Mastery	No. of Items	1 (N=6)		2 (N=0)		3 (N=12)		4 (N=118)	
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Add/Subtract Whole Numbers	- RS	+0.17	+0.10			+0.08	+0.15	+0.37	+2.70 ^{**}
	- M	0.00	0.00			0.00	0.00	+0.08	+2.37 [*]
2. Multiply Whole Numbers	- RS	+1.50	+2.24			+0.17	+0.56	+0.15	+1.59
	- M	+0.50	+1.46			+0.08	+0.56	+0.02	+0.53
3. Divide Whole Numbers	- RS	+1.83	+3.84 ^{**}			+1.08	+1.86	+0.68	+5.33 ^{***}
	- M	+0.33	+1.58			+0.33	+2.35 [*]	+0.13	+2.39 [*]
4. Add/Subtract Decimals	- RS	+2.83	+3.00 [*]			+0.50	+0.80	+1.33	+5.49 ^{***}
	- M	+0.33	+1.58			-0.08	-0.43	+0.25	+4.69 ^{***}
5. Multiply Decimals	- RS	-0.17	-0.21			-0.33	-0.89	+1.53	+8.27 ^{***}
	- M	0.00	-			-0.08	-1.00	+0.47	+8.66 ^{***}
6. Divide Decimals	- RS	+1.50	+2.24			+0.83	+1.89	+0.92	+5.32 ^{***}
	- M	+0.17	+1.00			0.00	0.00	+0.31	+5.14 ^{***}
7. Units of Measure	- RS	+1.50	+4.39 ^{**}			-0.67	-1.68	+0.21	+1.54
	- M	+0.17	+1.00			-0.25	-1.39	+0.08	+1.68
8. Estimate Measurements	- RS	+1.17	+2.44			-1.17	-2.03	+0.43	+2.97 ^{**}
	- M	+0.17	+1.00			-0.42	-2.80 [*]	+0.10	+1.61
9. Measure	- RS	+0.50	+1.00			0.00	0.00	-0.06	-0.72
	- M	+0.17	+0.54			-0.08	-0.56	+0.03	+1.00
10. Measurement Relationships	- RS	-0.50	-1.17			-0.67	-2.00	+0.39	+2.98 ^{**}
	- M	-0.33	-1.58			-0.50	-3.32 ^{**}	+0.13	+2.13 [*]
TOTAL	- RS	+10.33	+2.31			-0.17	-0.06	+5.96	+6.53 ^{***}
	- M	+1.50	+1.46			-1.00	-1.28	+1.59	+6.26 ^{***}

Table 6 (continued)

Mathematics, Grade 6, Semester 2

Cell

Competency Raw Score/Mastery	No. of Items	1 (N= 5)		2 (N= 0)		3 (N=8)		4 (N=102)	
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Add/Subtract Fractions - RS	8	+2.00	+1.91			-0.63	-0.59	+0.32	+2.28*
- M		+0.40	+1.63			-0.13	-0.55	+0.03	+1.00
2. Multiply Fractions - RS	4	+1.00	+1.29			-0.13	-0.19	+0.11	+1.37
- M		+0.20	+1.00			0.00	0.00	+0.06	+2.51**
3. Divide Fractions - RS	4	+2.80	+3.81*			+1.38	+2.58*	+1.36	+6.45***
- M		+0.80	+4.00*			+0.25	+1.53	+0.38	+6.65***
4. Percent and Decimals - RS	5	+2.20	+4.49**			+0.50	+0.88	+1.10	+5.85***
- M		+0.80	+4.00*			0.00	0.00	+0.28	+5.04***
5. Shapes - RS	5	+1.60	+1.55			+0.13	+0.26	+0.22	+2.29*
- M		+0.40	+1.63			-0.13	-1.00	+0.06	+2.51**
6. Perimeter - RS	5	+2.20	+2.16			-0.25	-0.40	+0.43	+3.12**
- M		+0.60	+2.44			0.00	0.00	+0.10	+2.57**
7. Read Graphs - RS	4	+1.60	+3.14*			-0.88	-2.97*	+0.20	+2.93**
- M		+0.60	+2.45			-0.38	-2.05	+0.04	+2.03*
8. Word Problems - RS	3	+1.20	+3.21*			-0.63	-1.11	+0.18	+1.57
- M		+0.40	+1.63			-0.38	-1.43	+0.08	+1.65
TOTAL - RS	38	+14.60	+4.28**			-0.50	-0.19	+3.91	+6.71***
- M		+4.20	+4.33**			-0.75	-0.83	+1.03	+6.52***

Table 7. Mean differences and t-values for criterion-referenced summative posttests in seventh grade mathematics competencies.

Mathematics, Grade 7, Semester 1

Cell

Competency Raw Score/Mastery	No. of Items	1 (N= 7)		2 (N= 8)		3 (N=9)		4 (N=119)	
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Multiply Whole Numbers - RS	5	+1.14	+1.06	+0.75	+1.53	+0.33	+0.42	+0.56	+4.66***
		+0.43	+1.44	+0.25	+1.00	+0.22	+1.00	+0.15	+3.72***
2. Divide Whole Numbers - RS	5	+1.29	+0.93	+1.38	+3.27**	+1.22	+1.85	+0.58	+4.48***
		+0.14	+0.42	+0.38	+2.05	+0.33	+2.00	+0.13	+3.13**
3. Multiply Decimals- RS	5	+0.43	+0.39	+2.00	+2.16	+1.11	+2.44*	+1.43	+7.87***
		+0.29	+1.00	+0.38	+1.43	+0.33	+1.41	+0.40	+8.37***
4. Divide Decimals - RS	5	+0.43	+0.55	+1.88	+4.71**	+0.22	+0.32	+1.18	+6.97***
		+0.14	+0.55	+0.63	+3.42**	+0.22	+1.51	+0.34	+6.39***
TOTAL - RS	20	+3.29	+0.94	+6.00	+5.02**	+2.89	+1.54	+3.76	+9.34***
		+1.00	+1.02	+1.63	+4.33**	+1.11	+2.06	+1.03	+8.62***

Table 7 (continued)

Mathematics, Grade 7, Semester 2

Cell

Competency Raw Score/Mastery		No. of Items	1 (N= 4)		2 (N=6)		3 (N=7)		4 (N= 107)	
			$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Add/Subtract Fractions	- RS	10	+2.25	+0.81	+3.83	+2.28	+4.57	+3.36*	+4.04	+11.41***
	- M		+0.50	+1.00	+0.50	+2.24	+0.43	+2.12	+0.57	+11.43***
2. Multiply/Divide Fractions	- RS	10	+2.00	+0.75	+2.00	+1.46	+3.43	+2.92*	+3.07	+9.80***
	- M		0.00	0.00	+0.33	+1.58	+0.29	+1.55	+0.45	+8.38***
3. Percent of a Number	- RS	5	+0.50	+0.30	+2.50	+7.32***	+2.14	+4.21**	+1.36	+7.96***
	- M		+0.25	+0.52	+0.83	+5.00**	+0.43	+2.12	+0.37	+6.93***
4. Fractional Equivalent of a Percent	- RS	5	-0.25	+0.15	+2.83	+5.94**	-0.29	-0.40	+1.32	+6.56***
	- M		0.00	0.00	+0.83	+5.00**	-0.29	-1.55	+0.38	+7.07***
5. Area	- RS	5	+1.25	+0.61	+1.83	+2.61*	-0.43	-0.39	+1.33	+7.11***
	- M		+0.25	+0.52	+0.50	+2.24	0.00	0.00	+0.35	+7.19***
6. Construct/ Interpret Graphs	- RS	5	0.00	0.00	+0.17	+0.18	0.00	0.00	+0.23	+1.75
	- M		-0.25	-1.00	0.00	0.00	+0.14	+0.55	+0.02	+0.53
7. Word Problems	- RS	3	+0.25	+0.24	0.00	0.00	0.00	0.00	+0.29	+2.73**
	- M		0.00	0.00	+0.17	+1.00	0.00	0.00	+0.23	+4.08***
TOTAL	- RS	43	+6.50	+0.61	+13.17	+3.79**	+9.43	+2.70*	+11.63	+13.03***
	- M		+0.75	+0.33	+3.17	+3.63*	+1.00	+2.05	+2.37	+12.35***

Table 8. Mean differences and t-values for criterion-referenced summative posttests in eighth grade mathematics competencies.

Mathematics, Grade 8, Semester 1

Cell

Competency Raw Score/Mastery	No. of Items	1 (N= 30)		2 (N= 98)		3 (N= 0)		4 (N= 25)	
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Divide Whole Numbers	- RS	5	+0.70	+2.80 ^{**}	+0.40	+3.22 ^{**}		-0.04	-0.23
	- M		+0.23	+2.04 [*]	+0.08	+1.81		-0.04	-1.00
2. Average	- RS	5	+2.07	+4.36 ^{***}	+1.02	+4.52 ^{***}		+0.76	+2.19 [*]
	- M		+0.43	+4.18 ^{***}	+0.23	+4.36 ^{***}		+0.16	+2.14 [*]
3. Divide Decimals	- RS	5	+1.63	+4.34 ^{***}	+0.71	+4.70 ^{***}		+1.20	+3.93 ^{***}
	- M		+0.37	+2.80 ^{**}	+0.23	+3.64 ^{***}		+0.36	+3.67 ^{***}
TOTAL	- RS	15	+4.40	+5.24 ^{***}	+2.13	+5.89 ^{***}		+1.92	+3.22 ^{***}
	- M		+1.03	+4.55 ^{***}	+0.55	+4.78 ^{***}		+0.48	+3.36 ^{**}

Mathematics, Grade 8, Semester 2

Cell

Competency Raw Score/Mastery	No. of Items	1 (N= 24)		2 (N= 87)		3 (N= 0)		4 (N=22)	
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Add, Subtract Fractions, Mixed Numbers	- RS	10	+5.96	+9.09 ^{***}	+2.13	+6.89 ^{***}		+1.86	+2.70 ^{**}
	- M		+0.92	+15.91 ^{***}	+0.37	+6.75 ^{***}		+0.32	+3.13 ^{**}
2. Sales Price	- RS	5	+2.04	+5.62 ^{***}	+1.17	+6.43 ^{***}		+1.50	+3.33 ^{**}
	- M		+0.58	+4.90 ^{***}	+0.39	+6.80 ^{***}		+0.36	+2.94 ^{**}
3. Volume	- RS	5	+2.33	+6.01 ^{***}	+1.41	+7.37 ^{***}		+1.14	+4.28 ^{***}
	- M		+0.63	+6.19 ^{***}	+0.43	+7.32 ^{***}		+0.45	+4.18 ^{***}
4. Word Problems	- RS	3	+1.29	+4.25 ^{***}	+0.69	+5.39 ^{***}		+0.36	+1.45
	- M		+0.50	+3.71 ^{***}	+0.22	+3.65 ^{***}		+0.18	+1.70
TOTAL	- RS	23	+11.63	+10.39 ^{***}	+5.40	+9.34 ^{***}		+4.86	+3.59 ^{**}
	- M		+2.63	+11.33 ^{***}	+1.40	+9.45 ^{***}		+1.32	+3.58 ^{**}

Table 9. Mean differences and t-values for criterion-referenced summative posttests in sixth grade science competencies.

Science, Grade 6, Semester 1

Cell

Competency Raw Score/Mastery	No. of Items	1 (N=9)		2 (N=3)		3 (N=23)		4 (N= 158)	
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Use Measurement Instruments - RS	6	+0.56	+0.89	+1.67	+1.88	+0.04	+0.09	-0.06	-0.51
- M		0.00	0.00	+0.67	+2.00	-0.04	-0.33	0.00	0.00
2. Scientific Method - RS	5	+0.78	+1.26	+1.33	+0.92	+1.57	+4.00 ^{***}	+1.39	+8.88 ^{***}
- M		+0.22	+1.00	+0.33	+1.00	+0.52	+4.22 ^{***}	+0.30	+7.62 ^{***}
3. Models, Diagrams, Charts - RS	4	+0.44	+0.94	+1.67	+5.00 [*]	-0.39	-1.82	-0.09	-1.14
- M		+0.11	+0.55	+1.00	-	-0.22	-2.01	-0.03	-0.90
TOTAL - RS	15	+1.78	+1.40	+4.67	+2.13	+1.22	+1.54	+1.23	+5.04 ^{***}
- M		+0.33	+0.76	+2.00	+3.46	+0.26	+1.03	+0.27	+3.89 ^{***}

Science, Grade 6, Semester 2

Cell

Competency Raw Score/Mastery	No. of Items	1 (N= 5)		2 (N= 3)		3 (N= 17)		4 (N= 137)	
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Nutrition - RS	4	-0.50	-0.59	-0.50	-0.20	-0.58	-1.93	-0.39	-3.32 ^{***}
- M		0.00	0.00	0.00	-	0.00	0.00	-0.01	-0.23
2. Personal Health - RS	7	+1.80	+3.67 [*]	+1.67	+1.39	+1.00	+2.09 [*]	+0.92	+5.79 ^{***}
- M		+0.20	+1.00	+0.33	+1.00	+0.24	+2.22 [*]	+0.25	+4.32 ^{***}
3. Conservation - RS	4	+1.00	+3.16 [*]	+0.33	+0.38	+0.41	+1.81	-0.07	-0.86
- M		+0.40	+1.63	0.00	0.00	+0.35	+2.95 ^{**}	-0.04	-0.96
4. Energy - RS	5	+2.20	+3.32 [*]	0.00	0.00	+0.76	+1.92	+0.96	+8.43 ^{***}
- M		+0.60	+2.45	0.00	0.00	+0.18	+1.00	+0.18	+5.26 ^{***}
TOTAL - RS	20	+5.00	+3.30 [*]	+2.67	+1.51	+2.41	+2.72 [*]	+1.92	+7.23 ^{***}
- M		+1.20	+3.21 [*]	+0.33	+1.00	+0.76	+2.63 [*]	+0.39	+4.30 ^{***}

Table 10. Mean differences and t-values for criterion-referenced summative posttests in seventh grade science competencies.

Science, Grade 7, Semester 1

Cell

Competency Raw Score/Mastery	No. of Items	1 (N= 20)		2 (N= 78)		3 (N=1)		4 (N= 34)	
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Use Lab Equipment - RS	3	-0.35	-1.68	-0.10	-1.00	-2.00	-	+0.03	+0.18
- M		-0.10	-1.00	+0.01	+0.33	-1.00	-	+0.12	+2.10*
2. Scientific Method - RS	3	-0.25	-0.93	+0.05	+0.46	-1.00	-	+0.15	+1.15
- M		-0.15	-1.37	-0.01	-0.28	-1.00	-	-0.03	-0.57
3. Use Science Information - RS	4	-0.45	-1.83	+0.18	+1.83	-1.00	-	+0.24	+2.77**
- M		-0.15	-1.83	+0.03	+0.70	0.00	-	+0.03	+1.00
4. Metric Measurement - RS	4	-0.30	-0.97	+0.12	+0.85	-1.00	-	+0.21	+1.31
- M		-0.15	-1.14	+0.08	+1.42	0.00	-	+0.09	+1.36
5. Cells - RS	4	-0.25	-0.82	+0.12	+0.82	0.00	-	+0.15	+0.66
- M		-0.10	-0.70	+0.12	+1.58	0.00	-	+0.09	+0.90
TOTAL - RS	18	-1.60	-2.20*	+0.36	+1.08	-5.00	-	+0.76	+2.13*
- M		-0.65	-2.22*	+0.22	+1.53	-2.00	-	+0.29	+1.97

Science, Grade 7, Semester 2

Cell

Competency Raw Score/Mastery	No. of Items	1 (N= 14)		2 (N= 65)		3 (N=0)		4 (N=33)	
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Human Development - RS	5	-0.07	-0.13	+0.11	+0.79	-	-	+0.33	+1.54
- M		-0.07	-0.37	+0.02	+0.22	-	-	+0.12	+1.44
2. Organs and Systems - RS	5	-0.14	-0.24	-0.15	-0.74	-	-	+0.24	+0.95
- M		-0.07	-0.43	-0.05	-0.65	-	-	0.00	0.00
3. Adaptation - RS	3	-0.50	-1.39	-0.14	-0.89	-	-	+0.42	+2.30*
- M		-0.29	-1.75	-0.12	-1.43	-	-	0.00	0.00
4. Ecology - RS	3	0.00	0.00	+0.34	+2.35*	-	-	+0.09	+1.14
- M		0.00	0.00	+0.12	+2.20*	-	-	+0.03	+1.00
TOTAL - RS	16	-0.71	-0.54	+0.15	+0.36	-	-	+1.09	+2.24*
- M		-0.43	-1.00	-0.03	-0.18	-	-	+0.15	+0.84

Table 11. Mean differences and t-values for criterion-referenced summative posttests in eighth grade science competencies.

Science, Grade 8, Semester 1

Cell

Competency Raw Score/Mastery		No. of Items	1 (N=15)		2 (N=76)		3 (N= 4)		4 (N= 87)	
			$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Scientific Method	- RS	4	-0.07	-0.19	-0.05	-0.40	0.00	0.00	+0.16	+1.34
	- M		0.00	0.00	+0.26	+0.42	0.00	-	+0.10	+2.11*
2. Metric Measurement	- RS	6	+1.00	+2.14*	+0.22	+1.14	-0.25	-1.00	+0.25	+2.06*
	- M		+0.27	+1.74	+0.12	+2.00*	0.00	-	+0.06	+1.92
3. Instruments	- RS	4	+0.27	+1.74	-0.03	-0.35	+0.50	+1.73	+0.11	+1.68
	- M		0.00	-	0.00	0.00	0.00	-	+0.02	+1.42
4. Interpret Maps	- RS	6	+1.00	+2.57*	+0.38	+2.49*	+0.75	+3.00	+0.90	+7.02***
	- M		+0.13	+1.00	+0.07	+1.69	0.00	-	+0.06	+1.92
TOTAL	- RS	20	+2.20	+2.86*	+0.53	+1.53	+1.00	+1.41	+1.43	+4.53***
	- M		+0.40	+1.70	+0.21	+2.01*	0.00	-	+0.24	+2.95**

Science, Grade 8, Semester 2

Cell

Science, Grade 6, Semester 2

Competency Raw Score/Mastery	No. of Items	1 (N=11)		2 (N=72)		3 (N= 3)		4 (N= 80)		
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	
1. Weather	- RS	5	+1.00	+1.75	-0.07	-0.40	+0.33	+0.50	+0.41	+3.29**
	- M		+0.27	+1.94	-0.01	-0.28	0.00	-	+0.04	+1.34
2. Seasonal Changes	- RS	2	+0.73	+3.07**	+0.35	+3.10**	0.00	0.00	+0.23	+2.11**
	- M		+0.27	+1.94	+0.15	+2.79**	0.00	-	+0.10	+2.19*
3. Reference Skills	- RS	4	+0.45	+1.84	+0.31	+1.91	+1.00	+1.73	+0.51	+3.78*
	- M		+0.18	+1.00	+0.16	+2.43*	+0.33	+1.00	+0.23	+3.82***
4. Terms	- RS	7	+0.82	+1.30	+0.90	+4.45***	+1.00	+1.00	+1.13	+7.01***
	- M		+0.18	+1.50	+0.16	+2.66**	0.00	-	+0.15	+2.97**
5. Ecology	- RS	4	+0.55	+1.94	+0.24	+1.75	-0.33	-1.00	+0.35	+3.78***
	- M		+0.27	+1.94	+0.03	+0.70	0.00	-	+0.11	+3.16**
6. Alleviating Environmental Problems	- RS	3	+0.18	+0.61	+0.26	+1.91	-1.00	-	+0.46	+4.22***
	- M		+0.09	+0.56	+0.18	+2.60**	0.00	-	+0.13	+2.43*
TOTAL	- RS	25	+3.73	+4.07**	+1.99	+3.44***	+1.00	+0.65	+3.09	+8.55***
30	- M		+1.27	+2.51*	+0.68	+2.85***	+0.33	+1.00	+0.75	+6.47***

Table 12. Mean differences and t-values for criterion-referenced summative posttests in sixth grade social studies competencies.

Social Studies, Grade 6, Semester 1

Cell

Competency Raw Score/Mastery		No. of Items	1 (N=18)		2 (N=0)		3 (N=13)		4 (N= 151)	
			$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Culture	- RS	20	+1.78	+2.06			-0.23	-0.19	+2.04	+8.02***
	- M		+0.33	+2.92**			+0.15	+1.00	+0.32	+6.85***
2. Physical and Cultural Differences	- RS	4	+0.56	+1.82			-0.62	-1.67	+0.29	+2.62**
	- M		+0.11	+0.81			-0.23	-1.15	+0.11	+1.93
3. Map Skills	- RS	3	+0.78	+2.52*			-0.85	-2.27*	+0.28	+3.10**
	- M		+0.39	+2.72*			-0.15	-0.81	+0.27	+5.47***
TOTAL	- RS	27	+3.11	+3.02**			-1.69	-0.98	+2.62	+7.53***
	- M		+0.83	+3.39**			-0.23	-0.54	+0.70	+7.06***

Table 12 (continued)

Social Studies, Grade 6, Semester 2

Cell

Competency Raw Score/Mastery	No. of Items	1 (N=12)		2 (N= 0)		3 (N= 9)		4 (N=126)	
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Government - RS	4	-2.38	-3.58 **			-4.33	-6.13 ***	-4.14	-23.44 ***
- M		+0.50	+2.57 *			+0.33	+2.00	+0.12	+2.59 *
2. Authorities - RS	2	+0.17	+0.69			0.00	-	+0.11	+2.53 **
- M		+0.17	+1.00			0.00	-	+0.10	+2.75 **
3. Needs/Wants - RS	3	+1.33	+4.69 ***			+1.22	+3.77 **	+1.03	+10.31 ***
- M		+0.75	+5.74 ***			+0.56	+3.16 **	+0.48	+9.52 ***
4. Economic System - RS	3	+0.50	+1.32			+0.56	+1.00	+0.32	+4.31 ***
- M		+0.08	+0.56			+0.33	+1.15	+0.10	+3.33 ***
5. Supply and Demand - RS	4	+0.50	+1.20			-0.33	-1.00	+0.89	+8.30 ***
- M		+0.33	+2.34 *			-0.11	-0.55	+0.48	+9.01 ***
6. Scarcity - RS	3	+0.67	+1.38			+0.11	+0.36	+0.77	+7.08 ***
- M		+0.25	+1.15			0.00	0.00	+0.28	+6.23 ***
7. Money - RS	2	+0.17	+0.80			+0.22	+0.51	+0.30	+3.81 ***
- M		+0.08	+0.56			+0.11	+0.43	+0.07	+1.99 *
TOTAL - RS	21	+4.08	+3.61 **			+2.00	+1.26	+3.84	+11.21 ***
- M		+2.17	+4.17 **			+1.22	+1.74	+1.62	+11.98 ***

Table 13. Mean differences and t-values for criterion-referenced summative posttests in seventh grade social studies competencies.

Social Studies, Grade 7, Semester I

Cell

Competency Raw Score/Mastery	No. of Items	1 (N= 20)		2 (N= 40)		3 (N= 5)		4 (N= 68)	
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Use Legend/Key on Map	- RS	-0.10	-0.23	+0.38	+1.75	-1.00	-3.16*	-0.01	-0.11
	- M	-0.05	-0.44	+0.10	+1.16	-0.20	-1.00	-0.01	+0.30
2. Know Oceans/ Continents	- RS	-0.10	-0.21	-0.43	+1.53	-1.60	-4.00*	+0.28	+1.75
	- M	-0.05	-0.57	+0.05	+0.70	0.00	-	+0.03	+0.81
3. Use Graphs Charts, Tables	- RS	-0.55	-0.84	+0.33	+1.23	-0.20	-1.00	-0.07	+0.49
	- M	-0.20	-1.45	0.00	0.00	0.00	-	+0.01	+0.57
TOTAL	- RS	-0.75	-0.62	+1.13	+2.13*	-2.80	-7.48**	+0.34	+1.06
	- M	-0.30	-1.24	+0.15	+1.14	-0.20	-1.00	+0.06	+0.75

Social Studies, Grade 7, Semester 2

Cell

Competency Raw Score/Mastery	No. of Items	1 (N= 13)		2 (N= 37)		3 (N= 3)		4 (N= 55)	
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. Geography	- RS	+0.46	+0.75	+0.11	+0.32	-1.00	-1.73	-0.17	-0.83
	- M	0.00	0.00	+0.14	+1.40	0.00	-	-0.02	-0.30
2. Vocabulary	- RS	-0.92	-0.71	+0.43	+0.69	-2.00	-1.15	+0.75	+2.13*
	- M	-0.15	-0.81	0.00	0.00	0.00	-	+0.06	+1.16
3. Facts About Cultures	- RS	-1.08	-1.28	+0.76	+2.65**	-3.33	-10.00**	+0.23	+0.76
	- M	-0.31	-1.48	+0.22	+2.74**	-1.00	-	0.00	0.00
TOTAL	- RS	-1.54	-0.77	+1.30	+1.41	-6.33	-3.59	+0.82	+1.21
	- M	-0.46	-1.20	+0.35	+1.97	-1.00	-	+0.05	+0.43

Table 14. Mean differences and t-values for criterion-referenced summative posttests in eighth grade social studies competencies.

Social Studies, Grade 8, Semester 1

Cell

Competency Raw Score/Mastery	No. of Items	1 (N= 28)		2 (N= 78)		3 (N= 3)		4 (N=79)		
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	
1. Graphs, Charts, Maps, Tables	- RS	10	-0.46	-1.49	-0.10	-0.74	-0.33	-0.38	+0.19	+1.36
	- M		0.00	0.00	-0.01	-0.30	0.00	-	+0.04	+1.14
2. Use Newspaper	- RS	5	-0.29	-0.91	-0.08	-0.43	0.00	0.00	+0.41	+2.99**
	- M		-0.04	-0.27	-0.01	-0.17	0.00	0.00	+0.16	+2.83**
3. Current Events	- RS	5	-0.29	-1.02	+0.17	+1.15	-0.33	-1.00	+0.14	+1.18
	- M		-0.04	-0.33	-0.06	+0.96	0.00	-	+0.08	+1.75
TOTAL	- RS	20	-1.04	-1.67	-0.01	-0.04	-0.67	-0.31	+0.73	+3.07**
	- M		-0.07	-0.30	+0.04	+0.33	0.00	0.00	+0.28	+3.23**

Table 14 Continued

Social Studies, Grade 8, Semester 2

Cell

Competency Raw Score/Mastery	No. of Items	1 (N= 23)		2 (N= 68)		3 (N=2)		4 (N= 60)	
		$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
1. 3 Branch System of Government - RS	7	+0.21	+0.47	+0.53	+2.23*	-1.00	-	+1.23	+5.82***
- M		+0.17	+1.70	+0.19	+2.42*	-0.50	-1.00	+0.33	+4.11**
2. Relationship between State and Federal Government - RS	3	-0.17	-0.61	+0.32	+2.29*	+1.50	+3.00	+0.37	+2.77**
- M		-0.04	-0.24	+0.15	+1.86	+1.00	-	+0.12	+1.99*
3. Rights and Responsibilities - RS	4	+0.57	+1.97	+0.18	+1.02	0.00	0.00	+0.22	+1.42
- M		+0.30	+2.30*	+0.19	+2.51*	-0.50	-1.00	+0.10	+1.10
4. Capitalism - RS	3	+0.57	+2.26*	+0.12	+0.72	+1.00	+1.00	+0.52	+3.42***
- M		+0.13	+1.00	+0.01	+0.17	+0.50	+1.00	+0.22	+3.20**
5. Supply and Demand - RS	3	-0.13	-0.38	+0.22	+1.95*	-0.50	+1.00	+0.22	-1.98*
- M		-0.09	-0.53	+0.10	+1.72	-0.50	-1.00	+0.07	+1.43
6. Economic Terminology - RS	4	+0.09	+0.27	+0.65	+3.37***	+0.50	+1.00	+0.73	+4.51***
- M		-0.04	-0.37	+0.16	+1.96	0.00	-	+0.27	+2.91**
7. Comparative Shopping - RS	5	+0.65	+1.65	+0.28	+1.97*	0.00	0.00	+0.53	+4.07***
- M		+0.26	+2.02	+0.09	+1.18	+0.50	+1.00	+0.32	+3.93**
8. Sequence of Historical Events - RS	4	+0.17	+0.64	+0.12	+0.68	+0.50	+1.00	+0.60	+3.53**
- M		+0.04	+0.44	+0.01	+0.19	0.00	-	+0.25	+2.96**
9. Cultural Aspects of Historical Events - RS	5	+0.39	+1.09	+0.53	+2.91**	+1.00	+1.00	+0.98	+4.58***
- M		+0.13	+0.83	+0.15	+1.86	0.00	-	+0.20	+3.01**
TOTAL - RS	38	+2.35	+1.59	+2.94	+4.52***	+3.00	-	+5.40	+8.96***
- M		+0.87	+1.67	+1.06	+4.11***	+0.50	+0.33	+1.87	+7.01***

Table 15. Mean differences and t-values for CTBS/S posttests by competency areas.

Grade Level	Competency Area	CTBS/S	Cell							
			1		2		3		4	
			$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t	$\bar{D}$	t
6	Language Arts	Total Language	+2.33 (3)	+0.14			-37.39 (18)	-2.80**	-4.49 (107)	-0.51
7	Language Arts	Total Language	-30.53 (15)	-1.05	+9.40 (20)	+0.54	-8.33 (3)	-0.24	+6.32 (89)	+0.75
8	Language Arts	Total Language	+15.00 (19)	+0.67	-7.03 (40)	-0.56	-23.50 (2)	-0.54	+3.57 (92)	+0.49
6	Mathematics	Total Mathematics	+45.00 (6)	+2.21			-38.67 (9)	-2.14	+11.30 (112)	+1.48
7	Mathematics	Total Mathematics	-37.67 (6)	-0.58	+21.38 (8)	+0.81	-37.75 (8)	-1.26	+15.27 (108)	+2.47*
8	Mathematics	Total Mathematics	+7.46 (24)	+0.45	+37.63 (93)	+5.26			+60.64 (22)	+3.38
6	Science	Science	-20.25 (8)	-1.34	+136.33 (3)	+4.48*	-48.50 (20)	-2.84**	-12.89 (150)	-1.93
7	Science	Science	-18.69 (16)	-0.83	-21.07 (71)	-1.80	-72.00 (1)		+4.07 (31)	+0.27
8	Science	Science	+30.67 (12)	+1.25	+6.27 (71)	+0.50	+54.25 (4)	+2.33	+15.65 (79)	+1.37
6	Social Studies	Social Studies	-15.88 (17)	-0.76			-101.00 (9)	-2.95*	-3.19 (133)	-0.36
7	Social Studies	Social Studies	-117.44 (18)	-4.13***	-21.06 (36)	-1.61	-17.75 (4)	-0.83	-6.03 (62)	-0.64
8	Social Studies	Social Studies	-12.70 (23)	-0.57	-6.82 (72)	-0.61	+57.67 (3)	+1.31	+49.03 (78)	+5.02***

Overall Project Results

The Competency-Based Middle School Program was designed to assist students in grades 6-8 in the attainment of student objectives at or above pre-established criterion levels. The program incorporates a competency-based (CBE) approach utilizing the principles of mastery learning to attain student learning objectives in the four basic subject areas of language arts, mathematics, science, and social studies. To the extent that such a program can be evaluated after a one year implementation period, the following summary is presented.

Hypotheses dealing with mathematics (grades 6, 7, 8), science (grades 6,8), and social studies (grade 6) competencies (Objectives 2, 3, and 4, respectively) were accepted with reservation on the basis of favorable trends in the data. Strong statistical evidence in favor of the experimental groups (i.e., project students designated to Cell 1 and Cell 2) in grade 8 mathematics competencies is noteworthy. The hypothesis addressed in Objective 1 dealing with language arts competencies (grades 6, 7, 8) was not supported by the data. Hypotheses dealing with CTBS/S subtest scale scores in language arts (grades 6, 7, 8), mathematics (grades 6, 7, 8), science (grades 6, 7, 8), and social studies (grades 6, 7, 8) in objectives 5, 6, 7, and 8, respectively, revealed no significant differences between project students and their counterparts with the following exceptions: (1) project students (Cell 2) demonstrated significantly higher achievement than control students on posttest achievement for CTBS/S science subtest scale scores in grade 6; and, (2) control students demonstrated significantly higher achievement than project students (Cell 1) on posttest achievement for CTBS/S social studies scale scores in grade 7.

COMPETENCY-BASED SECONDARY SCHOOL PROJECT

Project Abstract or Overview

The Competency-Based Secondary School (CBSS) Project is designed to assist all high school students attain the practical knowledge and skills they will need to fulfill their societal roles of citizen, employee, and consumer. Specifically, the project aims at helping students attain minimum competencies in the areas of citizenship, consumer economics, language arts, and mathematics through mastery learning instructional techniques and procedures.

Students in grades nine through eleven who did not demonstrate mastery of the minimum competencies and objectives in any or all of the four content areas on a criterion-referenced pretest served as the target group for the project. Prior to the opening of school in the fall of 1979, the project director and curriculum coordinator conducted an inservice training program designed to: (1) help teachers acquire the knowledge and skills needed to implement mastery learning strategies in a competency-based program setting; (2) assist the person at the school responsible for coordinating the testing program develop an understanding of his or her role in summative testing and record keeping; and, (3) provide administrators with the information needed to monitor and manage the program.

During the 1979-80 implementation year, all teachers with sections of English I, II, or III, General Math I or II, and Civics (encompassing citizenship and consumer economics) used the instructional units and procedures which had been developed and pilot tested the previous two years to assess student performance and monitor student progress according to the mastery learning model. These classes were heterogeneously grouped, and the instruction in the minimum competencies and objectives served as only a segment (approximately nine weeks) of the regular course instruction.

In May of 1980 criterion-referenced posttests were administered to all 9th, 10th, and 11th graders. Students were assessed with test items keyed to instruction in the minimum competencies and objectives at their appropriate grade level. Analysis of the data was achieved by comparing the performance of the students being served by the project with their counterparts (control group) at the same school the previous May (1979).

Using chi-square and analysis of covariance (ANCOVA) procedures, results of the data analysis revealed positive trends in the attainment of competencies in language arts (grades 9, 10, 11), mathematics (grades 9, 10), and consumer economics (grade 9) over a one year implementation of the CBSS Project. The competencies in citizenship (grade 9) were not supported by the data. In addition, hypotheses dealing with CTBS/S subtest scale scores in language arts (grades 9, 10, 11), mathematics (grades 9, 10), and social studies (grade 9) revealed no significant differences between project students and their counterparts. Given the scope of the CBSS Project in terms of competencies and grade levels observed, the results appeared to be supportive of a secondary competency-based education program using mastery learning instructional techniques and procedures.

Evaluation Design

1. Evaluation Design:

The evaluation design utilized was a comparison group design which compared project students (i.e., site school 1979-80, grades 9-11) with their counterparts (i.e., site school 1978-79, grades 9-11) on such factors as summative test and CTBS subtest achievement, sex, and race. Students enrolled in the same courses (English I, II, and III, General Math I and II, and Civics) the previous year at the site school served as the control group or counterparts to the experimental group. In order to provide more information regarding the effectiveness of the solution intervention, grade 8 was also investigated. Since these students were not served by the project, it was hypothesized there would be no significant change in achievement (as measured in Objectives 1-7) in grade 8 between the 1978-79 school year and the 1979-80 school year. Data from grade 8 were analyzed in the same manner as grades 9-11 for comparison. Students in all comparison groups received identical pretesting and posttesting procedures in an effort to reduce the effects of extraneous variables. Furthermore, students involved in the pilot testing phase of the project (1978-79) were not observed during the implementation year (1979-80).

A chi-square procedure was used to assess Objectives 1-4 (summative test scores). By partitioning appropriate CTBS/S scores into percentile ranges, an expected proportion of students demonstrating mastery on the summative tests in the various content areas during implementation (i.e., project students) was predicted by observing the proportion of students who demonstrated mastery of the summative tests in the various content areas during the 1978-79 school year (i.e., project student counterparts). The chi-square procedure compared the expected proportion to the observed proportion of project students who had mastered specific competencies during spring 1980 summative testing.

Statistical control was accomplished for Objectives 1-7 through the use of Analysis of Covariance (ANCOVA). CTBS/S subtest scale scores obtained in May 1978 (for project student counterparts) and May 1979 (for project students) were used to covary on the dependent variables for Objectives 1-7 (i.e., the summative test scores and the CTBS/S subtest scale scores obtained in May 1979 and May 1980, respectively). The independent variables of race and sex were used in the ANCOVA model, and statistical analysis was performed by grade level.

2. Evaluation Instruments:

a. Criterion-Referenced Tests (Objectives 1-4)

The CBSS summative tests are criterion-referenced, locally developed tests designed to assess mastery in citizenship, consumer economics, language arts, and math. The tests were administered before and after instruction (May 1979 and May 1980) to the graduation class of 1983, ninth graders during the implementation year. Appropriate subtests were administered in May 1979 to uninstructed ninth, tenth, and eleventh grade students and in May 1980 to instructed ninth, tenth, and eleventh grade students.

Validity: One of the first major tasks of the project was the identification of the minimum competencies and related objectives in each content area. This

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was achieved in a systematic and collaborative manner involving teachers, other educators and local citizens during a series of reviews and revisions from the summer of 1977 through spring of 1978. The project staff then assisted "lead" teachers in each content area as they wrote enabling and terminal performance indicators to provide task analysis information for instructional purposes and to add specificity regarding what a student must be able to do in order to demonstrate mastery of the minimum competencies and related objectives.

Following inservice training on "How to Write Criterion-Referenced Test Items", a team of four teachers in each content area wrote the first draft of criterion-referenced test items utilizing the terminal performance indicators described above. During the next five months all items were reviewed at least twice by testing and measurement specialists and revised or discarded. The report from the 1979 Title IV-C team-site visit noted that the feedback through these technical reviews for the establishment of content validity was excellent. Retained items were filed in item banks according to the minimum competency and related objective they were designed to measure.

During April of 1979 all summative test items were pilot tested on a limited number of students (N=200) at the site school. The same items were piloted at three other schools where students had not been exposed to pilot testing of the instructional units, which took place during spring 1979 at the site school.

After the tests were scored and analyzed through the computer services of a local university, all items were examined and evaluated in the following manner: (1) comparing overall scores on the item by both instructed and uninstructed groups during piloting; (2) determining specificity of the item as reflection of the objective and performance indicator; (3) checking the point biserial correlation of the item with the total test score; (4) noting the extent of parallelism of correspondent items in the two test forms (A & B); and, (5) observing the number of students choosing distractors in the item.

As a result of the item analysis and evaluation process and in preparation to gather baseline data, some items were modified to improve distractors and to clarify wording of the stems. Items were deleted when the data indicated they were too easy or difficult, they did not accurately reflect the objective, or they were not parallel to the item on the alternate form of the test. KR²⁰ reliability estimates of the CBSS summative tests obtained from the eighth grade (May 1979 administration) ranged from .70 to .90 for the content areas of language arts, mathematics, consumer economics, and citizenship.

Criterion Levels: In preparing to set the standards for determining mastery of the objectives, minimum competencies, and competency areas (math, language arts, citizenship and consumer economics), the project staff studied various methods and procedures available for standard setting. Two test/measurement specialists and the site faculty provided input into the subsequent decisions. It was decided, since various methods which purport to remove much of the arbitrary nature of standard setting are both time consuming and costly, to reject them and set standards agreed upon by the project staff, the test/measurement specialists, and the site faculty.

It was agreed that a student must correctly answer two of the three (67%) summative items keyed to an objective in order to be certified as having achieved the objective. To attain a competency, a student must have met 75% of the objectives which comprise the competency and had to attain all (100%) of the minimum competencies in each of the four competency (content) areas.

Test Administration: The project staff, with the assistance of a guidance counselor and the school librarian, administered the criterion-referenced tests at four testing sites within the schools (the site school and the local middle school where eighth graders were tested). Prior to test administration, the project director conducted a planning meeting with the test administrators and distributed directions to them in an effort to standardize testing procedures.

b. Comprehensive Tests of Basic Skills (Objectives 5-7)

This standardized norm-referenced achievement test was administered district wide in grades 1-12. In addition, the state of South Carolina has adopted the Comprehensive Tests of Basic Skills for its state-wide testing program in grades 3, 6, and 11.

Validity: Although the content validity of the CTBS/S subtests in language arts, math, and social studies is not as appropriate as the locally developed criterion-referenced tests with respect to the skills to be mastered by project students, these instruments were utilized to provide a convenient and cost effective supplemental assessment of project students and their counterparts. The CTBS subtests provided a "macroscopic view" of important content areas and behavioral levels on a national level.

Reliability: The technical bulletin provides information on the internal consistency of each subtest at each grade level. These reliability coefficients range from .84 to .97 for total language, total math and social studies.

Norms: Standardization of the CTBS/S was based upon a 1973 sample drawn from public and Catholic schools within the fifty states. The sample comprised approximately 130,000 students in grades 1-12. Students at the site school were administered levels 2, 3, or 4 of the subtests (grades 8-11), and the norms for these levels and grades for the Southeast region were based upon a sample of 17,312 learners.

3. Data Gathering Evidence:

The following chart A depicts an overview of the design in terms of how each project objective relates to evaluation instruments, data collection, and data analysis.

CHART A

Record of Data Collection and Analysis

DATA COLLECTION

OBJECTIVE	EVALUATION INSTRUMENTS	Collected On Whom	When Collected	Collected by Whom
1. By May 1980 the students (grades 9, 10 and 11) being served by the project will demonstrate significantly higher (.05 level) achievement (mastery) in language arts than their counterparts in the same school in 1978-79.	Locally developed summative (criterion-referenced) tests	9th, 10th, and 11th graders	May 1979 and May 1980	Project Staff
2. By May 1980 the students (grades 9, 10 and 11) being served by the project will demonstrate significantly higher (.05 level) achievement (mastery) in mathematics than their counterparts in the same school in 1978-79.	Locally developed summative (criterion-referenced) tests	9th, 10th and 11th graders	May 1979 and May 1980	Project Staff
3. By May 1980 the students (grades 9, 10 and 11) being served by the project will demonstrate significantly higher (.05 level) achievement (mastery) in consumer economics than their counterparts in the same school in 1978-79.	Locally developed summative (criterion-referenced) tests	9th, 10th, and 11th graders	May 1979 and May 1980	Project Staff

CHART A

Record of Data Collection and Analysis

OBJECTIVE	EVALUATION INSTRUMENTS	DATA COLLECTION		
		Collected On Whom	When Collected	Collected by Whom
4. By May 1980 the students (grades 9, 10 and 11) being served by the project will demonstrate significantly higher (.05 level) achievement (mastery) in citizenship than their counterparts in the same school in 1978-79.	Locally developed summative (criterion-referenced) tests	9th, 10th, and 11th graders	May 1979 and May 1980	Project Staff
5. By May 1980 the students (grades 9, 10 and 11) being served by the project will demonstrate significantly higher achievement (.05 level) in language arts than their counterparts in the same school in 1978-79.	CTBS/S-Norm-referenced achievement test in Language Arts	9th, 10th, and 11th graders	March 1979 and March 1980	Regular district testing administered by site faculty
6. By May 1980 the students (grades 9, 10 and 11) being served by the project will demonstrate significantly higher achievement (.05 level) in mathematics than their counterparts in the same school in 1978-79.	CTBS/S-Norm-referenced achievement test in Mathematics	9th, 10th, and 11th graders	March 1979 and March 1980	Regular district testing administered by site faculty
7. By May 1980 the students (grades 9, 10 and 11) being served by the project will demonstrate significantly higher achievement (.05 level) in social studies than their counterparts in the same school in 1978-79.	CTBS/S-Norm-referenced achievement test in Social Studies	9th, 10th, and 11th graders	March 1979 and March 1980	Regular district testing administered by site faculty

CHART A (CONT'D)

DATA ANALYSIS

How Analyzed	Analysis
1. Student achievement (mastery) comparison between project students and their counterparts	Chi square
2. Student achievement (mastery) comparison between project students and their counterparts	Chi square
3. Student achievement (mastery) comparison between project students and their counterparts	Chi square
4. Student achievement (mastery) comparison between project students and their counterparts	Chi square
5. Student achievement comparison between project students and their counterparts on total Language Arts subtest scores.	Analysis of Covariance (ANCOVA)
6. Student achievement comparison between project students and their counterparts on total Mathematics subtest scores.	Analysis of Covariance (ANCOVA)
7. Student achievement comparison between project students and their counterparts on Social Studies subtest scores.	Analysis of Covariance (ANCOVA)

Results and Analysis

The reader is referred to the preceding section (Evaluation Design) for an explanation of the chi-square and analysis of covariance (ANCOVA) procedures used in the analysis of the data. In an effort to make this section more readable, Tables 1-4 (chi-square results), Tables 5-9 (ANCOVA results), and Figure 1 follow the narrative for this section.¹

Results for Each Objective

Objective #1. By May 1980 the students (grades 9, 10, 11) being served by the project will demonstrate significantly higher (.05 level) achievement (mastery) than their counterparts in the same school in 1978-79. The data will be obtained in May 1979 and May 1980 from locally developed summative tests in the area of language arts.

The first hypothesis is investigated by examining the chi-square results (Table 1) and the analysis of covariance (ANCOVA) treatment effects (Table 5) of the experimental and comparison groups for the criterion-referenced summative posttests in language arts competencies.

To observe whether project students demonstrated significantly higher (.05) achievement (mastery) than their counterparts, a chi-square procedure compared the expected proportion to the observed proportion of project students who had mastered specific language arts competencies during spring 1980 summative testing. As depicted in Table 1, project students demonstrated significantly higher achievement than their counterparts in the language arts competencies of Listening Skills (grade 9), Writing (grade 10), Locating Information (grade 10), and Employment (grade 11). In general, most of the achievement gains were demonstrated by students classified in the lower CTBS/S percentile ranges (i.e., P₁-P₂₉ and P₃₀-P₄₉) which would include the majority of students needing to master minimum competencies. With the exception of the Spelling competency (grade 10), the percentage of project students mastering language arts competencies exceeded the percentage of their counterparts.

Additional information is presented in Table 5 involving analysis of covariance treatment effects for language arts competencies. While project students significantly outperformed their counterparts in the language arts competencies of Writing (grade 10) and Employment (grade 11), no significant differences were noted in other language arts competencies.

¹Tables 5-9 report only the analysis of covariance (ANCOVA) treatment effects for the criterion-referenced summative posttests in language arts, mathematics, consumer economics, and citizenship competencies and for the CTBS/S posttests by competency area. Although the independent variables of race and sex were observed in the ANCOVA model, the only significant differences noted in examining total items per grade level were as follows: race, $p < .05$ (9th grade language arts competency total); and treatment by race, $p < .05$ (9th grade language arts competency total).

The lack of significant differences in treatment effects noted between project students and their counterparts may be more an artifact than a reflection of the CBSS Project. In a minimum competency setting, there may be little room for "improvement" on total items correct for a particular competency when comparing project students to their counterparts. The amount of experimental gain of project students, taking into consideration the total number of items as well as the mean number of items answered correctly by the comparison group on a particular competency, is presented in Table 5 as a different way of looking at changes between project students and their counterparts. Positive experimental gains of 8% (grade 9), 30% (grade 10), and 66% (grade 11) are noted in Table 5.

Due to the scope of the first hypothesis in terms of competencies and grade levels observed, trends in the data were considered in determining the significance of results. On the basis of this discussion, the first hypothesis appears (with reservation) to be supported by the data.

Objective #2. By May 1980 the students (grades 9, 10, 11) being served by the project will demonstrate significantly higher (.05 level) achievement (mastery) than their counterparts in the same school in 1978-79. The data will be obtained in May 1979 and May 1980 from locally developed summative tests in the area of mathematics.

The second hypothesis is investigated by examining the chi-square results (Table 2) and the analysis of covariance (ANCOVA) treatment effects (Table 5) of the experimental and comparison groups for the criterion-referenced summative posttests in mathematics competencies.

To observe whether project students demonstrated significantly higher (.05) achievement (mastery) than their counterparts, a chi-square procedure compared the expected proportion to the observed proportion of project students who had mastered specific mathematics competencies during spring 1980 summative testing. As indicated in Table 2, no significant differences were found between project students and their counterparts on achievement (mastery) in the mathematics competencies (grades 9 and 10). Due to the limited number of project students and their counterparts, achievement gains could not be attributed to any particular CTBS/S percentile range(s). However, the percentage of project students mastering mathematics competencies exceeded the percentage of their counterparts in all competencies.

Additional information is presented in Table 6 involving analysis of covariance treatment effects for mathematics competencies. While project students significantly outperformed their counterparts in the mathematics competencies of Definitions and Symbols (grade 10) and the total number of items (grade 10), no significant differences were noted in other mathematics competencies.

The lack of significant differences in treatment effects noted between project students and their counterparts may be more an artifact than a reflection of the CBSS Project. In a minimum competency setting, there may be little room for "improvement" on total items correct for a particular competency when comparing project students to their counterparts. The amount of experimental gain of project students, taking into consideration

the total number of items as well as the mean number of items answered correctly by the comparison group on a particular competency, is presented in Table 6 as a different way of looking at changes between project students and their counterparts. Positive experimental gains of 23% (grade 9), and 36% (grade 10) are noted in Table 6.

Due to the scope of the second hypothesis in terms of competencies and grade levels observed, trends in the data were considered in determining the significance of results. On the basis of this discussion, the second hypothesis appears (with reservations) to be supported by the data.

Objective #3. By May 1980 the students (grades 9, 10, 11) being served by the project will demonstrate significantly higher (.05 level) achievement (mastery) than their counterparts in the same school in 1978-79. The data will be obtained in May 1979 and May 1980 from locally developed summative tests in the area of consumer economics.

The third hypothesis is investigated by examining the chi-square results (Table 3) and the analysis of covariance (ANCOVA) treatment effects (Table 7) of the experimental and comparison groups for the criterion-referenced summative posttests in consumer economics competencies.

To observe whether project students demonstrated significantly higher (.05) achievement (mastery) than their counterparts, a chi-square procedure compared the expected proportion to the observed proportion of project students who had mastered specific consumer economics competencies during spring 1980 summative testing. As depicted in Table 3, project students demonstrated significantly higher achievement in the consumer economics competencies of Money Management (grade 9) and Purchasing Basic Needs (grade 9). Most of the achievement gains in the Money Management competency were demonstrated by students classified in the higher CTBS/S percentile ranges (i.e., P₅₀-P₇₄ and P₇₅-P₉₉) while achievement gains in the Purchasing Basic Needs competency appeared to be evenly demonstrated by students classified in all four CTBS/S percentile ranges. The percentage of project students mastering consumer economics competencies exceeded the percentage of their counterparts in both competencies.

Additional information is presented in Table 7 involving analysis of covariance treatment effects for consumer economics competencies. Project students significantly outperformed their counterparts in both consumer economics competencies (grade 9). Table 7 also presents the amount of experimental gain of project students, taking into consideration the total number of items as well as the mean number of items answered correctly by the comparison group on a particular competency, as a different way of looking at changes between project students and their counterparts. A positive experimental gain of 47% (grade 9) is noted in Table 7.

Due to the scope of the third hypothesis in terms of competencies and grade levels observed, trends in the data were considered in determining the significance of results. On the basis of this discussion, the third hypothesis appears to be supported by the data.

Objective #4. By May 1980 the students (grades 9, 10, 11) being served by the project will demonstrate significantly higher (.05 level) achievement (mastery) than their counterparts in the same school in 1978-79. The data will be obtained in May 1979 and May 1980 from locally developed summative tests in the area of citizenship.

The fourth hypothesis is investigated by examining the chi-square results (Table 4) and the analysis of covariance (ANCOVA) treatment effects (Table 8) of the experimental and comparison groups for the criterion-referenced summative posttests in citizenship competencies.

To observe whether project students demonstrated significantly higher (.05) achievement (mastery) than their counterparts, a chi-square procedure compared the expected proportion to the observed proportion of project students who had mastered specific citizenship competencies during spring 1980 summative testing. As indicated in Table 4, the comparison group (i.e., counterparts) demonstrated significantly higher achievement than project students in the Rights and Responsibilities competency while no significant differences in achievement between project students and their counterparts were noted in the Problem Solving competency. While the percentage of project students mastering the Problem Solving competency exceeded the percentage of their counterparts, the reverse was true in the Rights and Responsibilities competency.

Additional information is presented in Table 8 involving analysis of covariance treatment effects for citizenship competencies. The comparison group (i.e., counterparts) significantly outperformed project students in the Rights and Responsibility competency while no significant differences in achievement between project students and their counterparts were noted in the Problem Solving competency. Table 8 also presents the amount of experimental gain of project students, taking into consideration the total number of items as well as the mean number of items answered correctly by the comparison group on a particular competency, as a different way of looking at changes between project students and their counterparts. A negative experimental gain of -6% (grade 9) is noted in Table 8.

Due to the scope of the first hypothesis in terms of competencies and grade levels observed, trends in the data were considered in determining the significance of results. On the basis of this discussion, the fourth hypothesis does not appear to be supported by the data.

Objective #5. By May 1980 the students (grades 9, 10, 11) being served by the project will demonstrate significantly higher achievement (.05 level) than their counterparts in the same school in 1978-79. The data will be obtained in May 1979 and May 1980 from CTBS/S tests in the area of language arts.

The fifth hypothesis is investigated by examining the analysis of covariance (ANCOVA) treatment effects (Table 9) of the experimental and comparison groups for the total language subtest of the Comprehensive Tests of Basic Skills. Objective 5 is related to Objective 1 in that the content area of language arts

was observed in both objectives. Although attainment of Objective 5 is not absolutely essential to program success, the CTBS/S subtest in language arts provides a "macroscopic view" of an important content area on a national level.

CTBS/S subtest scale scores obtained in May 1978 (for project student counterparts) and May 1979 (for project students) were used to covary on the dependent variable for Objective 5 (i.e., the CTBS/S total language subtest scale scores obtained in May 1979 and May 1980, respectively). As indicated in Table 9, no significant differences were found between project students and their counterparts on posttest achievement for CTBS/S total language subtest scale scores in grades 9, 10, and 11. On the basis of this discussion, the fifth hypothesis does not appear to be supported by the data.

Objective #6. By May 1980 the students (grades 9, 10, 11) being served by the project will demonstrate significantly higher achievement (.05 level) than their counterparts in the same school in 1978-79. The data will be obtained in May 1979 and May 1980 from CTBS/S tests in the area of mathematics.

The sixth hypothesis is investigated by examining the analysis of covariance (ANCOVA) treatment effects (Table 9) of the experimental and comparison group for the total mathematics subtest of the Comprehensive Tests of Basic Skills. Objective 6 is related to Objective 2 in that the content area of mathematics was observed in both objectives. Although attainment of Objective 6 is not absolutely essential to program success, the CTBS/S subtest in mathematics provides a "macroscopic view" of an important content area on a national level.

CTBS/S subtest scale scores obtained in May 1978 (for project student counterparts) and May 1979 (for project students) were used to covary on the dependent variable for Objective 6 (i.e., the CTBS/S Total Mathematics subtest scale scores obtained in May 1979 and May 1980, respectively). As indicated in Table 9, no significant differences were found between project students and their counterparts on posttests achievement for CTBS/S Total Mathematics subtest scale scores in grades 9 and 10. On the basis of this discussion, the sixth hypothesis does not appear to be supported by the data.

Objective #7. By May 1980 the students (9, 10, 11) being served by the project will demonstrate significantly higher achievement (.05 level) than their counterparts in the same school in 1978-79. The data will be obtained in May 1979 and May 1980 from CTBS/S tests in the area of social studies.

The seventh hypothesis is investigated by examining the analysis of covariance (ANCOVA) treatment effects (Table 9) of the experimental and comparison groups for the social studies subtest of the Comprehensive Tests of Basic Skills. Objective 7 is related to Objectives 3 and 4 in that the content area of social studies was observed in all three objectives. Although attainment of Objective 7 is not absolutely essential to program success, the CTBS/S subtest in social studies provides a "macroscopic view" of an important content area on a national level.

CTBS/S subtest scale scores obtained in May 1978 (for project student counterparts) and May 1979 (for project students) were used to covary on the dependent variable for Objective 7 (i.e., the CTBS/S social studies subtest scale scores obtained in May 1979 and May 1980, respectively). As indicated in Table 9, no significant differences were found between project students and their counterparts on posttest achievement for CTBS/S social studies subtest scale scores in grade 9. On the basis of this discussion, the seventh hypothesis does not appear to be supported by the data.

Table 1. Chi-square results for criterion-referenced summative posttests in language arts competencies

Grade Level	Competency (# of items)	Treatment Group	Percentage of Masters within Percentile Range					X ² (3df)	P
			P ₁ - P ₂₉	P ₃₀ - P ₄₉	P ₅₀ - P ₇₄	P ₇₅ - P ₉₉	Total		
9	#1 Listening Skills (9 items)	Comparison	2/15 13.3	9/26 34.6	18/27 66.7	20/23 87.0	49/91 53.9	15.363	<.01
		Experimental	5/10 50.0	15/26 57.7	29/40 72.5	39/51 76.5	88/127 69.3		
9	#4 Spelling (9 items)	Comparison	6/15 40.0	9/26 34.6	19/27 70.4	16/23 69.6	50/91 55.0	7.570	<.10
		Experimental	4/10 40.0	16/26 61.5	32/40 80.0	43/51 84.3	95/127 74.8		
9	#3 Reading (21 items)	Comparison	4/15 26.7	14/26 53.9	24/27 88.9	22/23 95.7	64/91 70.3	5.216	ns
		Experimental	6/10 60.0	18/26 69.2	35/40 87.5	50/51 98.0	109/127 85.8		
10	#1 Listening Skills (3 items)	Comparison	5/6 83.3	10/13 76.9	18/18 100.0	19/19 100.0	52/56 92.9	2.017	ns
		Experimental	15/16 93.8	26/26 100.0	26/26 100.0	20/20 100.0	87/88 98.9		
10	#3 Reading (3 items)	Comparison	6/6 100.0	11/13 84.6	18/18 100.0	19/19 100.0	54/56 96.4	.790	ns
		Experimental	15/16 93.8	26/26 100.0	26/26 100.0	20/20 100.0	87/88 98.9		
10	#5 Writing (6 items)	Comparison	7/14 50.0	18/30 60.0	32/41 78.1	50/52 96.2	43/56 76.8	25.663	<.001
		Experimental	6/11 54.5	17/24 70.8	35/39 89.7	30/33 90.9	75/88 85.2		
10	#4 Spelling (3 items)	Comparison	4/6 66.7	12/13 92.3	17/18 94.4	17/19 89.5	50/56 89.3	1.899	ns
		Experimental	12/16 75.0	21/26 80.8	19/26 73.1	20/20 100.0	72/88 81.8		
10	#6 Locate information (9 items)	Comparison	1/6 16.7	8/13 61.5	16/18 88.9	18/19 94.7	43/56 76.8	21.717	<.001
		Experimental	10/16 62.5	21/26 80.8	26/26 100.0	20/20 100.0	77/88 87.5		
11	#7 Employment (12 items)	Comparison	6/25 24.0	16/27 59.3	11/16 68.8	25/30 83.3	58/90 59.2	13.664	<.01
		Experimental	6/8 75.0	16/17 94.1	14/16 87.5	17/17 100.0	53/58 91.4		

Table 2. Chi-square results for criterion-referenced summative posttests in mathematics competencies

Grade Level	Competency (# of items)	Treatment Group	Percentage of Masters within Percentile Range					X ² (3df)	P
			P ₁ - P ₂₉	P ₃₀ - P ₄₉	P ₅₀ - P ₇₄	P ₇₅ - P ₉₉	Total		
9	#2 Basic operations (36 items)	Comparison	1/4 25.0	2/9 22.2	6/13 46.2	0/1 0.0	9/27 33.3	∞	ns
		Experimental	1/6 16.7	3/10 30.0	6/9 66.7	1/1 100.0	11/26 42.3		
9	#4 Measuring and Estimation (6 items)	Comparison	0/4 0.0	2/9 22.2	3/13 23.1	0/1 0.0	5/27 18.5	∞	ns
		Experimental	3/6 50.0	1/10 10.0	3/9 33.3	1/1 100.0	8/26 30.8		
10	#1 Definitions and Symbols (3 items)	Comparison	7/9 77.8	6/6 100.0	1/2 50.0	1/1 100.0	15/10 83.3	4.050	ns
		Experimental	1/1 100.0	13/13 100.0	8/8 100.0	1/1 100.0	23/23 100.0		
10	#2 Basic operations (3 items)	Comparison	5/9 55.6	6/6 100.0	2/2 100.0	1/1 100.0	14/18 77.8	.575	ns
		Experimental	1/1 100.0	11/13 84.6	8/8 100.0	1/1 100.0	21/23 91.3		
10	#3 Percents (6 items)	Comparison	3/9 33.3	2/6 33.3	2/2 100.0	1/1 100.0	8/18 44.4	2.805	ns
		Experimental	1/1 100.0	6/13 46.2	6/8 75.0	1/1 100.0	14/23 60.9		
10	#4 Measuring and Estimation (15 items)	Comparison	2/9 22.2	4/6 66.7	2/2 100.0	1/1 100.0	9/18 50.0	.335	ns
		Experimental	0/1 0.0	9/13 69.2	7/8 87.5	1/1 100.0	17/23 73.9		

Table 3. Chi-square results for criterion-referenced summative posttests in consumer economics competencies

Grade Level	Competency (# of items)	Treatment Group	Percentage of Masters within Percentile Range					χ^2 (3df)	P
			P ₁ - P ₂₉	P ₃₀ - P ₄₉	P ₅₀ - P ₇₄	P ₇₅ - P ₉₉	Total		
9	#1 Money Management (18 items)	Comparison	0/8 0.0	0/24 0.0	0/19 0.0	1/14 7.1	1/65 1.5	∞	<.001
		Experimental	1/12 8.3	2/10 20.0	12/34 35.3	13/18 72.2	28/74 37.8		
9	#2 Purchasing Basic Needs (12 items)	Comparison	0/8 0.0	2/24 8.3	3/19 15.8	3/14 21.4	8/65 12.3	∞	<.001
		Experimental	4/12 33.3	7/10 70.0	27/34 79.4	16/18 88.9	54/74 73.0		

Table 4. Chi-square results for criterion-referenced summative posttests in citizenship competencies

Grade Level	Competency (# of items)	Treatment Group	Percentage of Masters within Percentile Range					χ^2 (3df)	p
			P ₁ - P ₂₉	P ₃₀ - P ₄₉	P ₅₀ - P ₇₄	P ₇₅ - P ₉₉	Total		
9	#1 Problem solving (15 items)	Comparison	0/9 0.0	2/24 8.3	6/20 30.0	5/14 35.7	13/67 19.4	1.997	ns
		Experimental	0/12 0.0	2/10 20.0	9/34 26.5	7/18 38.9	18/24 24.3		
9	#2 Rights and Responsibilities (9 items)	Comparison	2/9 22.2	11/24 45.8	12/20 60.0	12/14 85.7	37/67 55.2	18.543	<.001
		Experimental	0/12 0.0	3/10 30.0	10/34 29.4	3/18 16.7	16/74 21.6		

Table 5. Analysis of covariance treatment effects for criterion-referenced summative posttests in language arts competencies

Grade Level	Competency (# of items)	$\bar{X}_C$	$\bar{X}_E$	F(df)	P	Experimental Gain
9	#1 Listening Skills (9 items)	6.29	6.71	1.77 (1,209)	ns	+16%
9	#4 Spelling (9 items)	7.16	7.30	.35 (1,209)	ns	+ 8%
9	#3 Reading (21 items)	16.94	17.10	.13 (1,209)	ns	+ 4%
9	Total (39 items)	30.38 (91)	31.10 (127)	.97 (1,209)	ns	+ 8%
10	#1 Listening Skills (3 items)	2.84	2.91	.38 (1,135)	ns	+44%
10	#3 Reading (3 items)	2.84	2.82	.03 (1,135)	ns	-13%
10	#5 Writing (6 items)	4.46	5.16	5.75 (1,135)	<.05	+45%
10	#4 Spelling (3 items)	2.45	2.42	.02 (1,135)	ns	- 5%
10	#6 Locate information (9 items)	7.91	8.25	.77 (1,135)	ns	+31%
10	Total (24 items)	20.49 (56)	21.56 (88)	2.06 (1,135)	ns	+30%
11	#7 Employment (12 items)	10.01 (98)	11.32 (58)	14.23 (1,147)	<.001	+66%

NOTE.

$\bar{X}_C$ = adjusted mean of comparison group

$\bar{X}_E$ = adjusted mean of experimental group

Experimental gain was calculated as follows:

$$\text{Experimental gain} = \frac{\bar{X}_E - \bar{X}_C}{\# \text{ items} \cdot \bar{X}_C}$$

Table 6. Analysis of covariance treatment effects for criterion-referenced summative posttests in mathematics competencies

Grade Level	Competency (# of items)	$\bar{X}_C$	$\bar{X}_E$	F (df)	P	Experimental Gain
9	#2 Basic operations (36 items)	22.97	26.93	2.72 (1,44)	ns	+30%
9	#4 Measuring and Estimation (6 items)	2.51	2.41	.03 (1,44)	ns	- 3%
9	Total (42 items)	25.48 (27)	29.34 (26)	2.10 (1,44)	ns	+23%
10	#1 Definitions and Symbols (3 items)	1.98	2.74	9.24 (1,32)	<.01	+75%
10	#2 Basic operations (3 items)	2.20	2.22	.00 (1,32)	ns	+ 3%
10	#3 Percents (6 items)	3.72	4.31	.77 (1,32)	ns	+26%
10	#4 Measuring and Estimation (15 items)	8.93	11.27	3.64 (1,32)	ns	+39%
10	Total (27 items)	16.84 (18)	20.54 (23)	4.50 (1,32)	<.05	+36%

NOTE.

$\bar{X}_C$ = adjusted mean of comparison group

$\bar{X}_E$ = adjusted mean of experimental group

Experimental gain was calculated as follows:

$$\text{Experimental gain} = \frac{\bar{X}_E - \bar{X}_C}{\# \text{ items} - \bar{X}_C}$$

Table 7. Analysis of covariance treatment effects for criterion-referenced summative posttests in consumer economics competencies

Grade Level	Competency (# of items)	$\bar{X}_C$	$\bar{X}_E$	F(df)	P	Experimental Gain
9	#1 Money Management (18 items)	8.12	10.79	22.55 (1,130)	<.001	+27%
9	#2 Purchasing Basic (12 items)	5.48	8.08	39.67 (1,130)	<.001	+40%
9	Total (30 items)	13.60 (65)	18.87 (74)	43.46 (1,130)	<.001	+47%

NOTE.

$\bar{X}_C$ = adjusted mean of comparison group

$\bar{X}_E$ = adjusted mean of experimental group

Experimental gain was calculated as follows:

$$\text{Experimental gain} = \frac{\bar{X}_E - \bar{X}_C}{\# \text{ items} - \bar{X}_C}$$

Table 8. Analysis of covariance treatment effects for criterion-referenced summative posttests in citizenship competencies

Grade Level	Competency (# of items)	$\bar{X}_C$	$\bar{X}_E$	F (df)	P	Experimental Gain
9	#1 Problem solving (15 items)	7.69	7.98	.27 (1,132)	ns	+ 4%
9	#2 Rights and Responsibilities (9 items)	6.10	5.23	6.30 (1,132)	<.01	-30%
9	Total (24 items)	13.79 (67)	13.20 (74)	.57 (1,132)	ns	- 6%

NOTE.

$\bar{X}_C$ = adjusted mean of comparison group

$\bar{X}_E$ = adjusted mean of experimental group

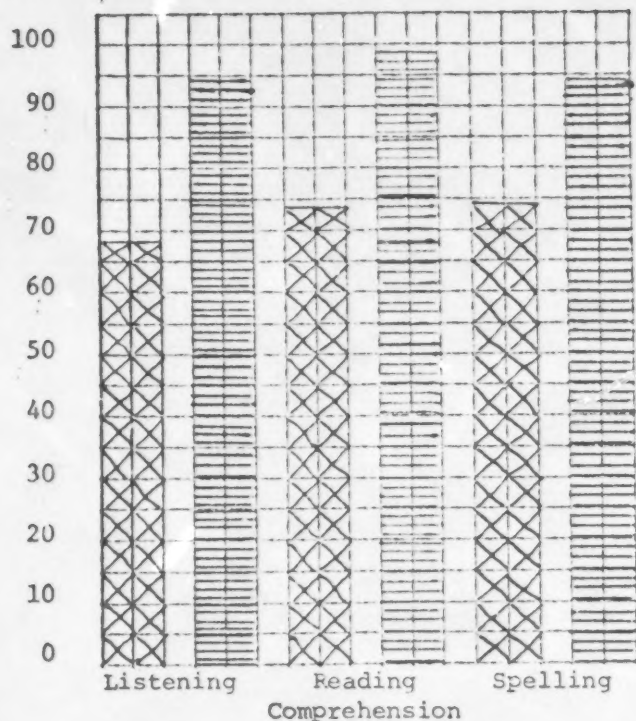
Experimental gain was calculated as follows:

$$\text{Experimental gain} = \frac{\bar{X}_E - \bar{X}_C}{\# \text{ items} - \bar{X}_C}$$

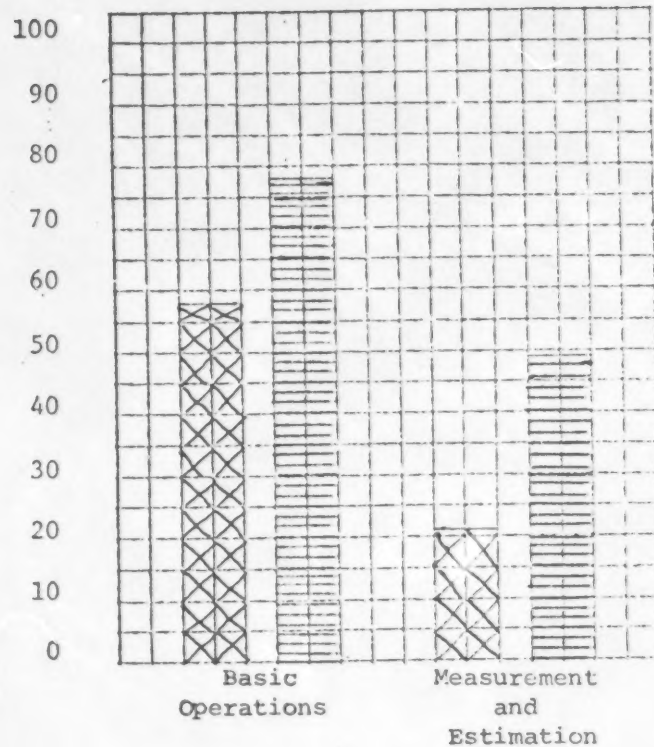
Table 9. Analysis of covariance treatment effects for CTBS/S posttests by competency areas

Grade Level	Competency Area	CTBS/S	$\bar{X}_C$	$\bar{X}_E$	F(df)	P
9	Language Arts	Total Language	574.82	589.54	2.76 (1,196)	ns
10	Language Arts	Total Language	597.81	591.73	.14 (1,133)	ns
11	Language Arts	Total Language	630.04	627.57	.06 (1,141)	ns
9	Mathematics	Total Mathematics	517.41	535.85	1.59 (1,44)	ns
10	Mathematics	Total Mathematics	549.02	538.57	.32 (1,29)	ns
9	Consumer Economics	Social Studies	562.03	563.32	.01 (1,128)	ns
9	Citizenship	Social Studies	563.53	562.91	.00 (1,130)	ns

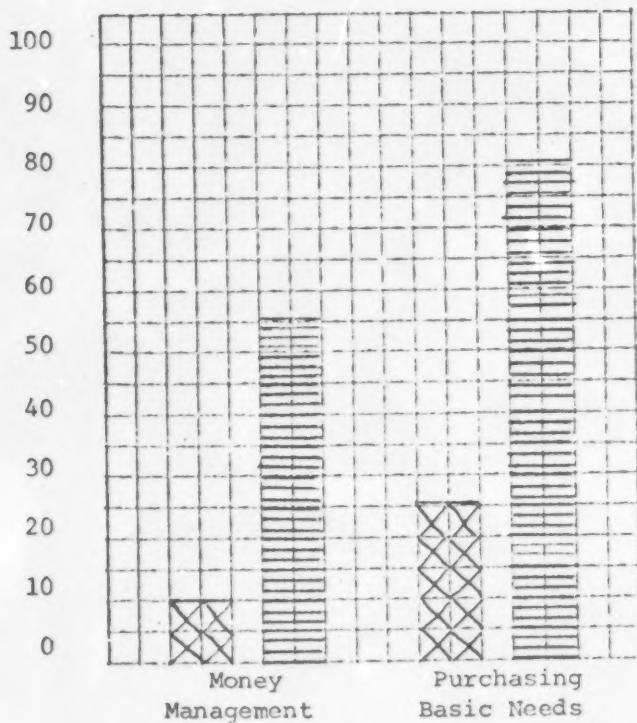
Language Arts



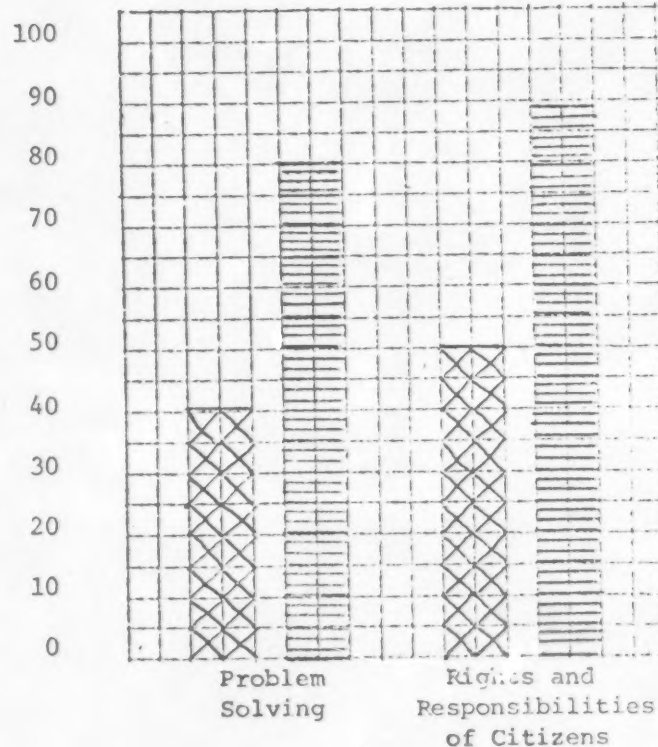
Mathematics



Consumer Economics



Citizenship



8th grade (1979)

9th grade (1980)

Figure 1. Percent of students in total class mastering minimum competencies after one year (9th grade) of instruction

Overall Project Results

The Competency-Based Secondary School (CBSS) Project is specifically designed to help students attain minimum competencies in the areas of language arts, mathematics, consumer economics, and citizenship through mastery learning instructional techniques and procedures over a three year period beginning with a competency assessment in the eighth grade and ending with remedial instruction and summative testing in the eleventh grade. To the extent that such a program can be evaluated after a one year implementation period, the following summary is presented.

Hypotheses dealing with language arts (grades 9, 10, 11) and mathematics (grades 9, 10) competencies (Objectives 1 and 2, respectively) were accepted with reservation on the basis of favorable trends in the data analysis. The hypothesis addressed in Objective 3 dealing with consumer economics competencies (grade 9) was accepted on the basis of strong statistical evidence in favor of the experimental group. The hypothesis addressed in Objective 4 dealing with citizenship competencies (grade 9) was not accepted due to the strong statistical evidence in favor of the comparison group on the Rights and Responsibilities competency. Hypotheses dealing with CTBS/S subtest scale scores in language arts (grades 9, 10, 11), mathematics (grades 9, 10), and social studies (grade 9) in objectives 5, 6, and 7, respectively, revealed no significant differences between project students and their counterparts.

Given the scope of the first four hypotheses in terms of competencies and grade levels observed, the results of the data analysis revealed positive trends in the attainment of competencies in language arts (grades 9, 10, 11), mathematics (grades 9, 10), and consumer economics (grade 9) over a one year implementation of the CBSS Project. The competencies in citizenship (grade 9) were not supported by the data.

Unanticipated Outcomes

As mentioned in the evaluation design, grade 8 was investigated in the same manner as grades 9, 10, 11 to provide more information regarding the effectiveness of the solution intervention. Since eighth grade students were not served by the project, it was hypothesized there would be no significant change in achievement (as measured in Objectives 1-7) in grade 8 between the 1978-79 year and the 1979-80 school year.

Analysis of covariance (ANCOVA) results revealed significant increases in eighth grade performance in the total language arts tests in the 9th grade ($p < .001$) and 10th grade ($p < .01$). However, no significant differences were noted in eighth grade performance between the 1978-79 and 1979-80 school years in the total summative posttests for the other competency areas. In addition no significant differences were noted in CTBS/S subtest scale scores in language arts, mathematics, and social studies.

The significant increases in eighth grade performance on total language arts tests (grades 9, 10) may be attributed to several factors. During the development of the project, middle school personnel were involved in writing instructional units and items for seven weeks during the summer of 1978 and for five weeks during the summer of 1979. In addition, the project was disseminated within the district through the district curriculum committee and numerous interviews by the media.

One other project outcome is noteworthy but not unanticipated. The reader is referred to Figure 1 which presents the percentage of ninth grade students who mastered appropriate competencies after instruction for one year compared to their performance in eighth grade summative testing. Dramatic increases are inherent in all four content areas: (1) language arts: Listening = +26%, Reading Comprehension = +26%, Spelling = +20%; (2) mathematics: Basic Operations = +20%, Measurements and Estimation = +28%; (3) consumer economics: Money Management = +46%, Purchasing Basic Needs = +55%; and (4) citizenship: Problem Solving = +39%, Rights and Responsibilities of Citizens = +37%. While some of these gains may be attributed to maturation, the final outcome should not be ignored.